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The Institute of British Foundrymen
The Institute of Vitreous Enamellers
The National Ironfounding Employers' Federation
The Welsh Engineers' and Founders' Association
and
The Foundry Trades' Equipment and Supplies Association

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A Metallurgical Revival

When we were informed that the basic-Bessemer department of the new Corby works of Messrs. Stewarts and Lloyds, Limited, had successfully cast their first ingot, we recalled that we were present, if not at the obsequies, at least the death throes of the last plant to be operated in Great Britain. At that time, we felt that the process showed great promise if intelligently operated under the best metallurgical conditions. This state of affairs definitely exists at Corby, where a striking example of rationalised processing has been established. A start is made with Northamptonshire ores, which exist in astronomical proportions. These are calcined or sintered and fed along with coke and local limestone to produce molten pig-iron. In its liquid condition this is poured into a Bessemer converter and air is blown which transfers all the impurities to the slag, leaving a pure steel possessing exceptionally good welding and deep-drawing properties.

This process, which was invented by two Britons—Thomas and Gilchrist—differs from the original Bessemer system in that basic conditions are established which permit of the removal of the phosphorus. Such an important installation as has been made at Corby is bound to give more employment to British miners, and the various grades of labour around blast furnaces, coke ovens, steelworks and foundries. The moulder has already benefited from the manufacture of the various prime movers, plant, buildings and housing estates initially necessary, whilst there will be a continuity of work in supplying ingot moulds, bottom plates and replacing parts about the plant.

The starting of the basic-Bessemer plant at Corby marks the attainment of a definite point in the construction of the new Corby works, an undertaking which was started two years ago. This means that the company has entered on the period of tuning in preparatory to full commercial production, which stage should be reached within a few months. The new blast furnaces were started earlier in the year, as were the ore-treating plant, coke ovens, by-product plant, rolling mills and tube works.

State Control in Industry

That the views embodied by Lord Melchett in his Enabling Bill, referred to in recent issues, are shared by his colleagues of Imperial Chemical Industries, Limited, is evident from a recent address by Sir Harry McGowan, chairman of the company. Now it might be thought that the result of the Enabling Bill would be to increase the sphere of government control in industry, but actually the reverse is the case, because it will really result in industries being self-governing. Thus they will not only not be any more State-regulated than they are, but the possibility of State control becomes ruled out. We have to bear in mind the enormous experiments in industry being made in Germany, Italy and the United States, to say nothing of Russia, the results of which are at present quite incalculable. One thing, however, is certain. The conditions of free competition which enabled British industry to expand and grow before the war are gone and may never return. Competition to freeze out the excess capacity due to present world-economic difficulties, capacity which might be badly needed when more normal economic conditions prevail, would inflict great harm on capital and on workers.

Sir Harry McGowan said that as yet no industry in a condition of reasonable prosperity had embarked upon self-government and yet managed to secure, on the one hand, the avoidance of over expansion, and, on the other hand, a satisfactory infusion of new ideas and new blood. The code system in the United States had been forced too rapidly and too extensively, with the result that where there should be order there was confusion. He would organise industry governed by a co-operative ideal. It was a public service, and aimed at satisfying the needs of the community in the most economic and efficient manner. As the world shrunk under scientific advance, there was greater need for order, reason and co-operation. Industry, like every other human activity, would ultimately find its fullest liberty in the voluntary restraint from which all true co-operation springs.

Nickel Cast Iron

Six Papers on nickel cast iron appear in the "Japan Nickel Review": "Effect of Nickel on Cast Iron," by E. NAMBA; "Mechanical Properties of Nickel Cast Iron," by T. MEZAKI; "Properties of Low-Nickel and Low-Nickel-Chromium Grey Cast Iron," by T. SATO; "Nickel and Nickel-Chromium Cast Iron in Internal-Combustion Engines," by Y. TAJI; "Special Cast Iron Used in Electrical Machinery," by H. NAKAMURA; and "Non-Magnetic Cast Iron," by G. WATANABE.

XUM

G.E.C. Progress During 1934

The General Electric Company, Limited, of Magnet House, Kingsway, London, W.C.2, in the course of a review of progress during the past year, point out that the number of turbo-alternators for industrial purposes (particularly where process steam is required), and the many slow- and medium-speed alternators which have been built at Witton Engineering Works, for export to all parts of the world, bear testimony to the improved position in heavy engineering. Moreover, there are now in course of construction two 62,500-k.v.a. turbo-alternators for Hams Hall Power Station, Birmingham, and a 20,000 k.v.a. set for Johannesburg Municipality. Further large turbo-alternators for export include two for the Palestine Electric Corporation, of 15,000 k.v.a. and 7,500 k.v.a. output respectively. Several most important industrial electrification schemes have been completed, including the conversion scheme at Ryhope Colliery; also the electrification of a semi-continuous bar and strip mill at the Courtybella Works, Newport, of the Whitehead Iron & Steel Company, Limited, completed during the year.

Many important items of colliery equipment have been introduced during the year, particularly for the purposes of coal-face mechanisation. Mention should be made of the portable mining sub-station, coal-face lighting equipment, pedestal-mounted flameproof oil circuit-breakers and flameproof lighting fittings of advanced design; many other appliances for collieries and mines have also been produced. Nearly all this apparatus has received the Buxton test certificate issued by the Mines Department.

A number of mixed-pressure and back-pressure turbines for driving generating plant have been installed in industries where pass-out steam for process work is required, and further turbines, such as 6,000, 12,000 and 15,000-k.v.a. units, for export to South Africa and Palestine, have been built for coupling to the turbo-alternators mentioned previously. Among orders completed for the iron, coal, steel and motor industries are turbo-blowers for the new Corby works of Messrs. Stewarts and Lloyds and other iron and steel works, and turbo-compressors for several North-Country collieries. Several coal- and coke-handling and screening plants have been installed during the year, and among recent orders is a large plant for a Chinese railway company. The "Chance" system of washing coal (sand-flotation process) has now been in operation for over twelve months in a South Yorkshire Colliery, and has given a consistently excellent performance within the stringent guarantees specified. Further plants are now in process of starting up or erection in South Wales, at the hydrogenation plant of Imperial Chemical Industries, Limited, in a colliery in the Midlands, and in South Africa.

Magnetic Permeability and Frequency

In a Paper in "Helv. Physica Acta," R. SÄNGER describes work on the relationship between the frequency and magnetic permeability of iron, nickel and cobalt, it being found that above a frequency of 10^3 to 10^5 cycles the ferro-magnetic permeability commences to fall.

G.E.C. Capital Increase

The directors of the General Electric Company, Limited, are taking steps to increase the capital to £9,600,000 by creating 2,000,000 new ordinary shares. The company will redeem on March 31 the whole of the balance of the 4½ per cent. first mortgage debenture stock then outstanding, at 110 per cent. In a circular to the shareholders, Lord Hirst, the chairman, states that the directors are advised that present conditions afford a favourable opportunity of replacing the outstanding debenture stock by an issue of ordinary shares. The directors propose that the ordinary share capital shall be increased by £2,000,000, the major portion of which it is their intention to use for the purpose of the debenture stock redemption.

Symposium on Corrosion

At the end of November the Verein deutscher Eisenhüttenleute, the Deutsche Gesellschaft für Metallkunde, the Verein deutscher Chemiker and Verein deutscher Ingenieure held their fourth joint meeting in Düsseldorf to discuss various practical aspects of the corrosion of iron and steel, with special reference to gas and hot-water pipes and heating installations. The corrosion of these pipes presents a serious problem and represents the loss of a large sum per annum for renewals and repairs in domestic and industrial heating installations. Cast iron and steel are the principal materials from which these pipes and installations are made, and in the period 1927 to 1933 the average output in Germany of steel tubes and pipes has been 600,000 tons and of cast-iron pipes 275,000 tons. C. CARIUS, of Essen, read a Paper on the corrosion of metals in water and aqueous solutions, which he discussed on electrochemical principles. H. STEINRATH and H. KLAS dealt with the corrosion of buried pipes and means for preventing such deterioration. Adequate protection is not afforded by metallic coatings, paint, chromate, phosphate and cement coatings, but considerable success has been obtained with tar, bitumen and jute servings. F. EISENSTECKEN discussed corrosion in the interior of water pipes and means for its prevention, and W. WUNSCH dealt with the same subject with reference to gas pipes. Other Papers on corrosion in heating appliances and installations were also presented, including one by G. TICHY on a comparison of pre-war and post-war steels as regards their behaviour in use for water supply and heating installations. W. SCHNEIDER dealt with modern theories and research relating to the protection of tubes and pipes against corrosion.

A Pioneer Metallurgist

DEATH OF MR. C. H. RIDSDALE

We very sincerely regret to record the death of our old friend Mr. C. H. Ridsdale. The Editor retains pleasant memories of hospitality showed to him during the war, when as a homeless wanderer he spent some time in Middlesbrough. Chemists all over the world recognise that they owe a debt of gratitude to Mr. Ridsdale's foresight and energy in providing them with drillings of standard composition so that they could test their own efficiency and the reliability of their own chemicals. Mr. Ridsdale was trained under the late Dr. Stead and participated in the original experiments for launching the basic-Bessemer process in England. Many foundrymen met him for the first time at the Middlesbrough Convention in 1930, when in conjunction with his son, Mr. N. D. Ridsdale, he presented a monumental Paper—still standard in foundry literature—on "The Pig-Iron Resources of Great Britain." The extreme thoroughness with which this Paper was prepared was typical of his industry. He was a familiar figure at the Iron and Steel Institute, where his views on scientific matters were always accorded the serious attention they deserved. He was a man of vast metallurgical experience, possessing strictly orthodox views, relying on oft-repeated bulk experiments rather than a snap test as a basis for his conceptions. Of a cheery disposition, with a real flair for making friendships, the passing of Mr. Ridsdale will be deeply regretted by a very large circle of people associated with the iron and steel trades. To Mr. N. D. Ridsdale, who is such a popular and highly esteemed member of the Institute of British Foundrymen, we offer, on behalf of the foundry industry, our sincere condolences.

Random Shots

In that vale of tears which constitutes a foundryman's progress from apprenticeship to the managerial chair, the individual comes up against many problems, and must of necessity give consideration to numerous technical variations of the ferrous industry. We hear a good deal from time to time of heat-treatment of metals, and "Marksman" has been privileged to be present at discussions on this subject when the heat has spread well round the conference circle with somewhat disastrous results! This vexed question of grain size, too! In "Marksman's" experience it goes distinctly *against* the grain with some people to admit that they are in the wrong.

* * *

Metaphorically, heat has always figured in our language, at any rate, in the colloquial part of it, and to find oneself in hot water seems to be a good deal worse than being in common or garden "trouble." "Marksman" recalls the phrase "in the soup," and since no self-respecting person would dream of insulting his palate by offering it cold soup, the presumption is that heat is once again the *raison d'être* of this homely saying. "Marksman" believes that a scent is often termed "red hot" in hunting and detective circles, while once in a way a commercial narrator manages to find a "blazing" market to write about. "Very hot, sir," cries the cricket enthusiast to the brilliant catch which ends the match, and perhaps loses us the ashes. There is a certain *degree* of heat, too, in "match" and, perchance, even in "ashes"!

* * *

But to get back to this heat-treatment again for a moment. "Marksman" presumes that from one aspect of heat-treatment hot chestnuts in a paper bag would figure at one end of the scale and rum punch at the other! Then there is the annealing process by the club's oldest member, who gets his back well against the fire to the exclusion of everyone else in the vicinity, and certainly makes his welcome anything but a warm one when he appears on the scene. Not unusually the club can boast of two or more advocates of this heat-treatment system, and their race for the fireplace always results in a dead-heat—as far as other members are concerned! * * *

The heat question crops up, too, in the stress and strain of this world. "I'll warm your hide for a tanner," cries the irate master to his apprentice, getting hot under the collar, or "choler" if you think that fits the case better. It is quite possible for two Eskimos to have a heated argument all amongst the ice and snow of the Polar regions, and the unlucky explorer may have a very hot time with a bear, although the temperature is, so to speak, a minus quantity. "Fire," cries the leader of the execution squad, and yet he is probably a cold-blooded fellow who nevertheless possesses the faculty of smoking without burning. Fierce resentment has kindled in the eyes of many a good old-fashioned heroine of Victorian romances, but it didn't mean that the poor lass went blind!

* * *

At the risk of being dubbed vulgar, "Marksman" would remind his readers that the policeman who rushes hotfoot in pursuit of the criminal does not of necessity need to change his socks when he comes off his beat. Probably the constable, being a steady fellow, was very rarely in hot water, but it does not follow that he shunned the bath, although he may have been a bit lukewarm about the cold variety. "Marksman" rather agrees with him, and would prefer to uphold the traditions of heat-treatment by half-an-hour's immersion (with the hot tap trickling to keep the temperature up) and the latest number of THE FOUNDRY TRADE JOURNAL held in clammy hands.

MARKSMAN.

Institute of British Foundrymen

LONDON BRANCH ANNUAL DINNER

The members of the London Branch of the Institute made the most, as usual, of the opportunity which their annual dinner affords of entertaining their many friends and supporters, at the Charing Cross Hotel, Strand, London, W.C.2, on Wednesday, December 19. They must have been gratified by the obvious pleasure derived by all from their attendance at this function. Mr. A. S. Beech, the Branch-President, ably presided.

Among those present were Sir Berkeley Sheffield, Bart., Mr. S. C. E. Lloyd, Mr. Roy Stubbs (President of the Institute), Mr. P. A. Russell (Past-President of the East Midlands Branch), Mr. Wesley Lambert, C.B.E., and Mr. V. C. Faulkner (Past-Presidents of the Institute and of the London Branch), Mr. W. B. Lake (Hon. Treasurer of the Institute and Past-President of the London Branch), Mr. H. O. Slater and Mr. C. H. Kain (Past-Presidents of the Branch), Mr. Kenneth W. Bridges, Mr. R. H. Brackenbury, Mr. V. Delport (Branch Vice-President), and Mr. H. W. Lockwood (Hon. Secretary).

The absence of Mr. F. O. Blackwell (Senior Vice-President of the Branch) and Mr. T. Makemson (Secretary of the Institute), due to illness, was greatly regretted).

The Toasts

The loyal toast having been honoured,

SIR BERKELEY SHEFFIELD, BART., proposed "The Institute of British Foundrymen." He recalled that he had had the honour to propose the same toast six years ago, and, rightly, he inferred that he had performed the task satisfactorily, inasmuch as he was entrusted with the proposal of the toast again. At that time, Mr. G. H. Russell was President of the Institute; on this occasion one of the guests of the Branch was Mr. P. A. Russell, who was apparently the "Benjamin" of the family, and one hoped that at some time in the future he would fill the office of President of the Institute with the same honour as had his brother.

Six years ago, continued Sir Berkeley, the foundry industry, and especially the light castings trade—the section with which he was more personally concerned—was in a particularly chaotic condition, due entirely, in his opinion, to the madness of cutting prices. It had taken half a decade to bring some commonsense into that industry, and at the moment we were finding, perhaps, a little better and a little more optimistic feeling as to its future.

Creation of Personnel

Although the Institute was essentially technical in its objects, it had other aims besides; it had ever before it both the practical and the general welfare of the industry. Undoubtedly in the past one of the main difficulties in finding suitable personnel for the administration of a foundry was the necessity that such personnel should combine practical knowledge with theoretical training. In the past there had been plenty of those who were called "practical" men, men with rule-of-thumb methods and possibly one or two notes in a messy notebook; there had been men also of very high technical knowledge buried in chemical formulæ, charts and drawings. Each type, in its way, was most estimable; but the man of real use, and who could produce something of tangible value to the community, was the man who combined both these aspects of foundry work. That was where the Institute came in. It desired to inoculate commonsense into the technician and the use of science into the practical man, and so turn out men of increasing value to the trade as a whole.

Costing Report Appreciated

One more among the many and divers matters to which the Institute was devoting its activities was that of finance. It was with the greatest interest that he had read the Report concerning costing—the most important matter in the financial departments of our undertakings. It was a source of great satisfaction that a sub-committee of the Institute was devoting special attention to this matter.

In coupling the name of Mr. Roy Stubbs with the toast, Sir Berkeley expressed the great personal pleasure it afforded him to do so; and he recalled that there had been no stronger advocate of co-operation among foundry owners than Mr. Roy Stubbs' uncle (the late Mr. Oliver Stubbs), who had worn the Presidential chain 12 years ago.

Sir Berkeley drew the attention of the members to the fact that Mr. Arthur Henderson, an Honorary Member of the Institute, and one who had risen from the position of an ordinary moulder to that of His Majesty's Minister for Foreign Affairs, had recently been awarded the Nobel Peace Prize. All foundrymen would be proud that such an honour had been conferred upon one of their number.

In conclusion, Sir Berkeley congratulated the Institute upon the admirable way in which it had extended and organised its work, and upon the judgment displayed in the choice of officers to handle it. And in a further tribute to Mr. Stubbs, Sir Berkeley recalled that Mr. Stubbs was associated with the Institute's largest Branch (Lancashire), the strength and power of which was but a reflection upon his organising ability and personal charm.

Efficiency through Personal Contact

MR. ROY STUBBS commenced his response to the toast in his usual jovial strain, but soon came down to serious matters. The theme which Mr. Stubbs developed in his speech—not unexpectedly, having regard to his temperament—was that of increasing facilities for personal contact within the Institute. In order to make the Institute of maximum service to the membership, he said, it seemed that a field which could be cultivated more intensively than it had been in the past was that of facilitating the acquaintance of members with one another. With this object in view, he suggested the appointment of a number of members, whose duty it would be to ensure that strangers became acquainted and should find real hospitality within the membership. As members became better acquainted they would more freely discuss their problems and were more likely to solve them.

There were those who had had the privilege of a very wide acquaintance among the membership of the Institute because of their prominence as Members of the Council or Committees. They had a full realisation of the value of such acquaintance. But what of the general run of the members, who, through diffidence or other causes, had not experienced this privilege? How about the member who had attended a convention or two and had found no congenial spirit with whom to associate, and had therefore retired into his shell and was wondering what it was all about? He and his fellows should be made to feel a real hospitality common to the entire membership.

Though it was realised that this was an object difficult of attainment, Mr. Stubbs emphasised that most things worth while were difficult, and that by reason of their very difficulty they demanded a more intensive and consistent effort to attain. Therefore, let the members definitely define the limits of their field and proceed to cultivate it so intensively that everyone would feel the importance of membership. Let them cultivate that friendly co-operative spirit to the "*nth*" power, allowing every member to feel a personal interest in the affairs of the Institute, regardless of his membership status.

Increasing Usefulness of Committee Work

It was pleasing that a larger number of members were from time to time entering into participation of the Institute's activities. The Institute was accorded recognition by other societies and associations; it was being invited to collaborate in investigations, standardisation and research. These activities enlisted the participation of increasing numbers of members in ever-widening spheres of service and, naturally, brought out more free acquaintanceship and a more widespread understanding of the individual attainments which, in turn, reflected credit on the Institute.

A Useful Reservoir

There were primarily two obligations which every member owed to the Institute. The first was to contribute from his experience, knowledge and ability to the Institute's work, and the second was to use his influence on friends, acquaintances and others to procure new members. The first obligation was not exemplified merely in the writing of papers; still another and very important function of the Institute was the work of its various committees. No member, however reluctant he might be to prepare a Paper—and at times it was difficult to procure Papers—should hesitate to serve on a committee handling a subject in which he was competent to advise and help. The difficulty was to ascertain the accomplishments and attainments of the members in order to make up the personnel of various committees. Mr. Stubbs pleaded that members should faithfully attend all sessions treating subjects within their scope and give freely of their knowledge and experience by entering into the discussion, or, if they hesitated to speak in public, they might submit their comments in writing. By so doing, they would not only clarify and co-ordinate their own convictions, but also establish themselves amongst their fellow members as having expert knowledge or useful experience along certain lines, and would consequently expose themselves to an invitation to participate more effectively in the Institute's activities.

Any organisation which sought to add to the sum total of human knowledge should not rely on super-intelligence vested in one or a few directing minds, but rather upon the cumulative effort of all its members working in harmony and with complete understanding of individual abilities and achievements, and willingness to give and take. No man was more unfortunate than he who thought he knew everything; on the other hand, no man could be more fortunate than he who had a large circle of friends and acquaintances willing to give help and advice from their knowledge and experience.

Dissemination of Specialised Knowledge

Again, Mr. Stubbs pleaded that no member should be misled by either of two errors which were common—to believe that their procedure and knowledge was so highly specialised that no one else could have any interest in it or could glean useful information from it, or that their operations were so commonplace that they had nothing to offer. Frequently, however, a knowledge of procedure in lines quite different might be the nucleus of an application, in a slightly different way, to some personal problem; many very important developments had their origin in what seemed at first to be a very simple and well understood fact. Many were inclined to minimise their attainments because development had been slow and not startlingly obvious, but nevertheless definite and actual, and they failed to appreciate the change until, perchance, a retrospection was indulged in.

Having had the opportunity of close contact with many of the leaders of the foundry industry, he was able to appreciate the more fully the advantages that accrued from a free interchange of ideas and experiences. He knew of no better medium than the Institute through which to accomplish development in the industry; the continued growth and success of the Institute must mean continued growth and success to the industry. Therefore, his plea was that all should avail themselves fully of the facilities it offered, and should help to enhance its usefulness by their participation, interest and effort.

The True Functions of Industrial Rings

MR. S. C. E. LLOYD (Messrs. Stewarts and Lloyds, Limited), proposing "The London Branch," addressed himself in the first place to the problem of the value of co-operation. The Institute of British Foundrymen, he said, had been built up to foster co-operation, and had achieved a remarkable amount of success in the foundry trade, particularly in the last few years. As had been pointed out by Sir Berkeley Sheffield, during the last six years the industry had put a stop to price cutting, which in Mr. Lloyd's opinion was the greatest evil in trade. Price cutting benefited no one; the consumer was just as badly off as the producer. At the beginning, the industry's raw material had to be won from the earth, and that represented the primary cost; at the other end of the scale there was the consumer, who could afford to pay a certain price for the finished product. Mr. Lloyd was interested primarily in the supply of the raw material. Surely the problem to be faced by all sections of the industry was that of dividing up the difference between the primary cost and the price which the consumer could afford to pay for the article ultimately produced. For many years it had been impossible for the various sections of the industry, or the various cogs in the wheel, to co-operate; but they were beginning to work together instead of in opposition, and that represented a tremendous step forward from the points of view of both the pig-iron industry and the foundry industry. The years between 1929 and the present time had been terrible; none of them had made much money, and many had lost a lot of money. But there was one redeeming feature, that the circumstances had impressed upon this great industry the absolute necessity for working together and avoiding the disastrous price cutting which had been practised in the years preceding 1930 and 1931. Generally speaking, those years were disastrous because everyone had started to fall over themselves to obtain business at any price in order to keep going. Perhaps that did not apply to the foundry industry so much as to many others.

Mr. Lloyd then went on to discuss the merits of industrial rings. He recalled that only a fortnight ago he had attended an informal dinner given by two well-known people who very definitely opposed the formation of rings and cartels. Their argument was quite reasonable—that if one section of an industry formed a more or less water-tight ring or cartel, that was bound to have the effect of bringing the rest, or another section of the consuming industries, together, and eventually the consumer and producer would be fighting one another to the detriment of both. On that occasion Mr. Lloyd had had the opportunity of arguing the matter from the opposite point of view, and he contended that the rings and cartels that we were seeking to form represented a preliminary step to a very much greater advance.

This brought him back to his original contention, that all must look upon the industrial situation from the point of view of the splitting of the difference between the cost of extracting the primary raw material from mother earth and delivering it to the customer in the form required at a price which that customer can pay. That was the primary function of our great industries and of every ring.

Eliminating the Inefficient

Rings, cartels and associations had been brought into disrepute in the past because it was felt by the individual buying material from them that their sole object was to exploit the customers and to get the maximum they could from them. Mr. Lloyd contended, however, that that was wrong. The primary internal function of that form of organisation was to eliminate, as painlessly as possible, the inefficient producer, so as to enable the trade as a whole to make the best profit it could, bearing in mind all the time that the consumer could pay only an economic price, and could not pay more. If the pig-iron industry and the foundry industry could hold together and bear that fact in mind and act on such a policy, not endeavouring to exploit anyone, or one another, it would redound to the benefit of the consumer, of the foundrymen, and of the pig-iron industry. This brought him back to realisation of the value of the work of the Branch, which had more than 200 members, and he believed he was right in saying that it was the most important individual Branch. He coupled with the toast the name of the Branch-President, Mr. A. S. Beech.

The Staff

The BRANCH-PRESIDENT, after expressing his thanks for the manner in which the toast had been proposed and received, took the opportunity of emphasising the *status quo*, and of thanking publicly all the officers and members of the Branch for the support they had given him during his year of office. He paid a tribute particularly to Mr. H. W. Lockwood for his wonderful work as Hon. Secretary, and admitted frankly that he would have been lost without his help. Mr. Lockwood had always been ready to shoulder the majority of the work of the Branch. He had guided and instructed the President in his duties, and very sincere thanks were more than due to him. The Branch-President also expressed his gratitude to Mr. Blackwell, the Senior Vice-President (whose absence due to illness was deeply regretted, and whose health, it was hoped, would be speedily restored), and to Mr. Delport, the Junior Vice-President, for their counsel and support. The members of Council as a whole came in for a meed of thanks for their consistent good service, spread over many years in some cases. This reference to the Council gave the Branch-President the opportunity also to acknowledge the generosity of the Directors of THE FOUNDRY TRADE JOURNAL in providing free accommodation for the Council meetings at their offices.

Membership

Coming to the Branch membership, the Branch-President recalled that he had made a strong appeal to each individual member to do his utmost to increase the numbers. Several gentlemen had given this matter their serious consideration, and it was pleasing to record that, as the result of their efforts, the membership had increased from 218 in June, 1934, to 225 to date, a net increase of 7.

Absorbing the Unemployed

The problem of increasing employment in this country has always been one to which Mr. Beech has devoted special attention, and it was natural, therefore, that on this occasion he should make a further appeal to foundry owners, works managers, foundry managers, and others who carried the responsibility of engaging labour. He pointed out that although conditions were improving, so that we have now about one million more men employed than was the case a few years ago, there were still approximately two million out of employment. It would be a wonderful thing if the foundry industry, together with the foundry equipment and supplies industry, could take a strong lead in reducing these numbers of unemployed. Most of those present at the dinner were feeling the benefit of the improvement in trade, as compared with the position two years ago. Therefore, if every type and kind of firm in this country who were experiencing better conditions would agree to find a job or jobs for one or several genuinely unemployed men, in accordance with the extent of their improved trading conditions, he was convinced that they would find their material prosperity increased eventually. The result would be a corresponding increase in public spending power, which would without doubt have beneficial repercussions all round. He recalled the scheme inaugurated some years ago whereby firms who employed discharged wounded soldiers were allowed to use a recognised seal on their notepaper and were awarded a certificate. He suggested that the unemployed to-day could be regarded as discharged wounded soldiers of industry, and that a similar scheme might be evolved, and would go a long way to overcome this problem, which was very serious not only for industry generally, but particularly for these fellows themselves. It was essential that these extra hands must be drawn from the ranks of the genuine unemployed and must not be simply additional men transferred from existing employment with other companies.

The Visitors

MR. V. DELPORT, Ing.E.C. (Junior Vice-President, London Branch), proposed "The Visitors," to all of whom he offered a hearty welcome. Referring to some of the visitors individually, he mentioned Sir Berkeley Sheffield, Bart., the Chairman of Southern Foundries, Limited, and the owner of a considerable amount of land in Lincolnshire containing a good deal of iron ore. Sir Berkeley, he said, had been one of the first to appreciate the possibilities of the establishment of light-castings foundries in the south of the country. He was also a man of vision, for his foundry was situated opposite an aerodrome; those who believed in the future of aircraft would appreciate that that was a very important step! The members of the Branch were grateful to Sir Berkeley for having attended the dinner and for the friendly and delightful way in which he had proposed the toast of the Institute.

Another guest whom Mr. Delport mentioned particularly was Mr. Charles Lloyd, of Messrs. Stewarts and Lloyds, Limited, and Chairman of the Pig-Iron Liaison Committee, which aimed at bringing the pig-iron producers into closer touch with the iron foundries. For that work alone the industry owed very much to him, and the members of the Branch were also grateful to him for his speech that evening, giving them a view of the future relations between consumers and producers.

Inasmuch as the members knew Mr. Roy Stubbs so well, it was unnecessary to embarrass him by saying too much about him. The Branch had always appreciated his good qualities, and since he had become President of the Institute he had given them the opportunity to appreciate those qualities even more. His presence reminded them, too, of the great work of his uncle, the late Mr. Oliver Stubbs, who was one of the leaders of the industry and of the Institute. Thanks were due also to Mrs. Roy Stubbs for her inspiration and support of the work of the Institute.

The other visitors whom Mr. Delport mentioned particularly were Mr. P. A. Russell, B.Sc., Past-President of the East Midlands Branch, who was doing valuable work also on behalf of the Institute as Convenor of its Cast Iron Sub-Committee; Commander Jameson, R.N., who was in charge of the foundry at H.M. Dockyard at Chatham; Mr. Frey, of Basle, Switzerland; Mr. R. H. Brackenbury, President of the Foundry Trade's Equipment and Supplies Association, and Mr. Kenneth Bridges, of whom much more would be heard in the coming year in connection with the Foundry Trades Exhibi-

(*Concluded on page* 52.)

Recent Developments in Welding as Applied to the Foundry Industry

By R. Tyler, F.I.C., and L. C. Percival, B.Sc.

(*Concluded from page* 20.)

A recently-developed process claims to have combined all the advantages of the cast-iron fusion-welding process and of the bronze-welding process, and to have eliminated all the disadvantages of bronze welding and practically all the disadvantages of the cast-iron fusion-welding process. The following table briefly summarises the points of comparison:—

Process.	Advantages.	Disadvantages.
Cast iron fusion	(1) No colour difference (2) Homogeneity. (3) Good penetration. (4) Strength.	(1) High temperature. (2) Risk of distortion. (3) Risk of cracking. (4) Necessity for preheating. (5) Longer time required. (6) Labour costs higher.
Bronze welding	(1) Lower temperature employed. (2) Risk of distortion lessened. (3) Risk of cracking negligible. (4) Work more quickly completed. (5) Reduced labour costs.	(1) Colour difference. (2) Non-homogeneous. (3) Less penetration. (4) Comparative weakness.
Recently developed low temperature welding process.	(1) No colour difference. (2) Homogeneity. (3) Good penetration. (4) Strength. (5) Lower temperature employed. (6) Risk of distortion lessened. (7) Risk of cracking negligible. (8) Work more quickly completed. (9) Labour costs reduced.	Almost eliminated.

Amongst the many applications of welding applied to steel castings, the following are most often met with:—Building up castings which will not "clean up" owing to insufficient allowance for machining, building up surfaces to remedy eccentricity caused by shifted cores, building up surfaces which remain rough and pitted after removal of the "headers" and are due to shrinkage effects not being completely overcome by feeding and adequate headers.

The average mechanical properties to be expected from a low-carbon steel casting are:—

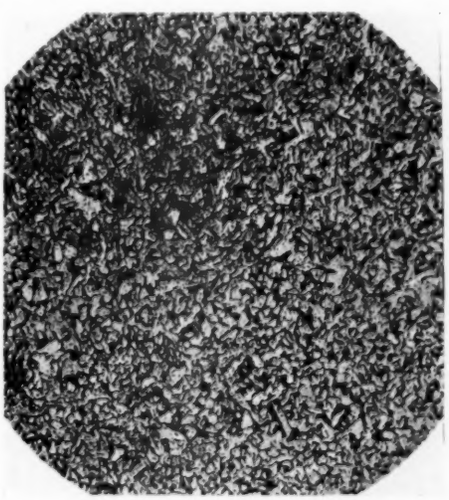
Mechanical tests.	As cast	Normalised.
Yield point ..	22.5	16.5 tons per sq. in.
Tensile strength	36.0	31.4 „ „
Elongation on 2 in. ..	10.5	27.0 per cent.
Bend test ..	35 deg.	180 deg.

Current oxy-acetylene-welding practice allows of the deposition of metal on mild-steel castings identical with the material of the casting.

Test figures given by steel specimens, consisting of all-weld metal deposited by the oxy-acetylene method, are consistently obtained as follow:

Yield point ..	18 to 19 tons per sq. in.
Tensile strength	28 „ 30 „ „
Elongation ..	18 „ 22 per cent. in eight diameters.
„ and	25 „ 30 „ „ in 2-in. gauge length.
Izod impact ..	45 „ 55 ft.-lbs.
Bend test ..	Bent through 180 deg. over a bar equal to 4 times the dia.

Typical all-weld-metal specimens giving the figures quoted above are shown by Fig. 5. The



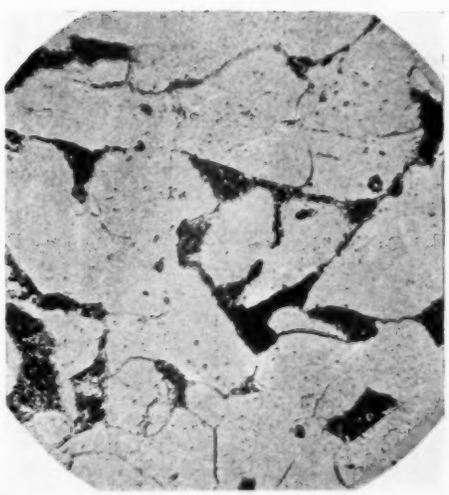


FIG. 5.—SHOWING TYPES OF WELD METAL TEST-PIECES USED BY THE WELDING INDUSTRY AND THE MICROSTRUCTURE (UNTREATED) AT 50 AND 600 MAGNIFICATIONS.

photomicrographs show their structure at magnifications of 50 and 600 diameters respectively. These specimens received absolutely no heat-treatment after depositions.

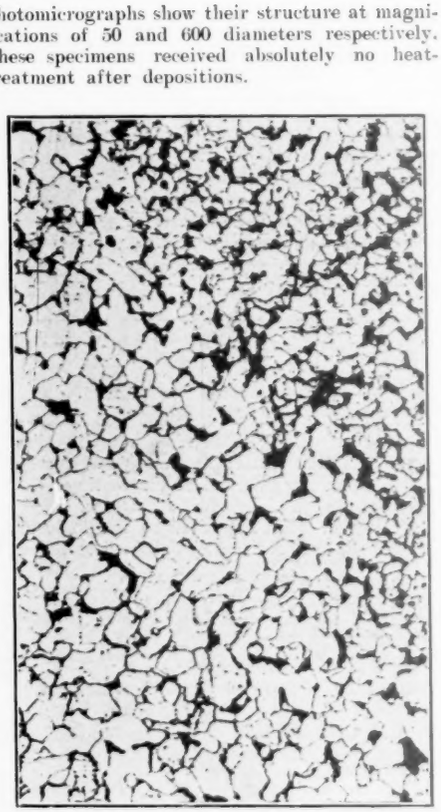


FIG. 6.—TYPICAL WELD. × 100.

A typical weld of this type is shown in Fig. 6 at a magnification of 100 diameters. With the development of alloy steel and iron castings, which is contemporary with high-temperature and high-pressure work, there has followed a development of high-class alloy steel and iron welding rods suitable for the oxy-acetylene welding process.

Propeller Repair

Ships' propellers which have suffered damage through contact with floating *débris* and/or erosion and corrosion are generally returned to the foundry for repairs, and the welding of small cast-iron propellers is regularly carried out by some firms in this country. In the cases where a new tip is required, it is necessary to produce it in the form of a new casting ready for joining on to the main blade. One method too well known to require description is to "burn on" the newly-made tip. In the case of erosion or corrosion which does not result in actual severance of a portion of the blade "burning on" is also resorted to, but this does not necessitate the preparation of a new cast piece.

The first case which came under the notice of one of the authors of the employment of fusion welding in this class of work was under circumstances where it was not considered expedient to return a damaged cast-iron propeller to the foundry. The extent of the damage was such that new tips could be obtained quickly, and in the meantime preparations were being made for welding them on to the blades. The welding in this case proved quite satisfactory.

A more recent problem which was submitted for solution was the repair of eroded and corroded areas, and the welding of a new tip to a manganese-bronze propeller. The complex brasses used in the production of propellers are specially designed to minimise corrosion and erosion, but alloys of identical composition do not necessarily prove satisfactory as welding rods for their repair. It was not only the satisfactory accomplishment of the welding which had to be considered, but the production of a weld metal which would exhibit the same characteristics as the parent metal. Having successfully solved these problems, the renewal of the eroded and corroded areas and the welding on of a new tip was proceeded with.

It is desired to stress the fact that such a rod has many more advantages than is at first realised; it greatly facilitates the work of the welder and results in a metallurgically-sound weld metal and junction. It is here implied that, particularly in the case of complex propeller alloys, the mere use as welding rods of sticks cast from a normal melt of the same material is not likely to lead to success. It can be confidently stated that the satisfactory completion of the particular repairs, which were of no small dimensions, was in a great measure due to a thorough appreciation of the correct requirements as regards welding rods and flux.

Fig. 7, at 100 diameters magnification, shows the microstructure of an experimental weld in manganese-bronze propellor material. The similarity between the weld metal and parent metal, and the perfect nature of the joint, will be appreciated.

Much that has been written about the application of welding to iron and steel castings applies equally well to non-ferrous castings, such as gunmetal, bearing bronzes, manganese bronze, aluminium bronzes, Monel metal, aluminium alloys and Elektron alloys. Here, again, the selection of the most suitable welding rod and flux is of vital importance, and the oxy-acetylene-welding process is the one almost invariably employed.

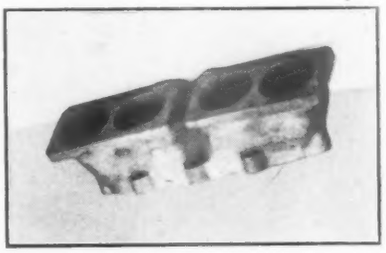


FIG. 8.—WELDED ELEKTRON CASTINGS.

Magnesium Alloy Welding

It is not proposed to deal with these alloys individually, but it would be appropriate to select one of the most recently developed, which represents the class of light alloys referred to as Elektron. One of the authors spent considerable time on the welding of Elektron alloys at an early stage of their development. These are alloys which were considered at one time to be either unweldable or very difficult to weld; here, again, the ultimate solution of the satisfactory welding of them lay in the selection of the correct welding rod and flux, but some of the Elektron alloys are not suitable for welding. Every foundry producing Elektron to-day is equipped with an oxy-acetylene-welding outfit, as are most foundries.

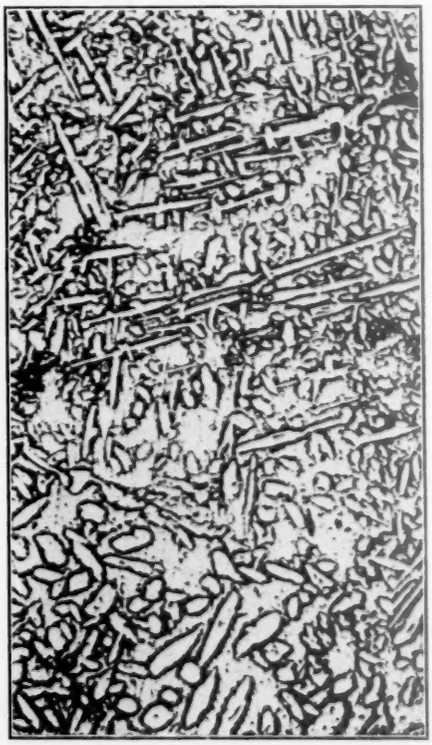


FIG. 7.—MICROSTRUCTURE OF A WELD MADE IN MANGANESE BRONZE. × 100.

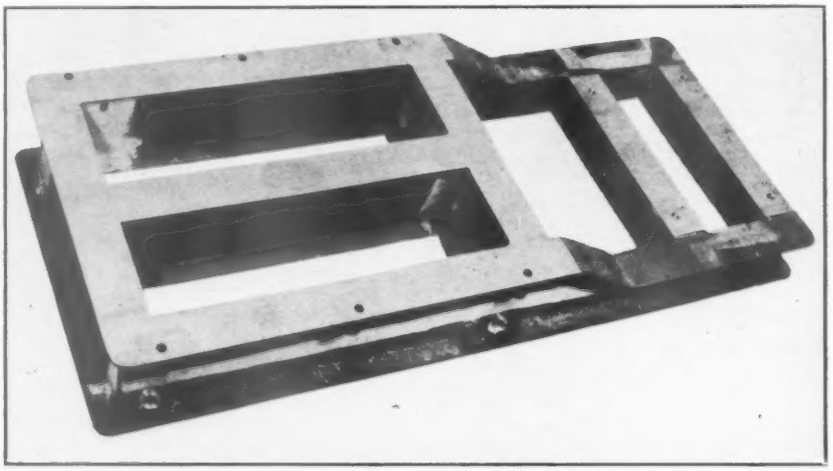


FIG. 9.—AN ALL-WELDED BEDPLATE.

Growth of Weldings

Replacement of castings by "weldings" is progressing rapidly. In some cases weldings supplant castings; in others, weldings are made up of castings and rolled mild steel; in others, weldings are composed of two or more castings welded together. Where time is a vital factor, welding is often of paramount importance, and where there is a saving in weight, welding means a large saving in transport costs. Rolled steel may be obtained in a large variety of sections which, by cutting, bending and welding, may be converted into weldings, which are superior in strength and ductility, and have a greater factor

of safety under applied loads combined with a saving in weight and material cost. Well-known examples of this type of work are dynamo and transformer housings, motor and engine bedplates. Examples of such an engine bedplate are shown in Figs. 9 and 10.

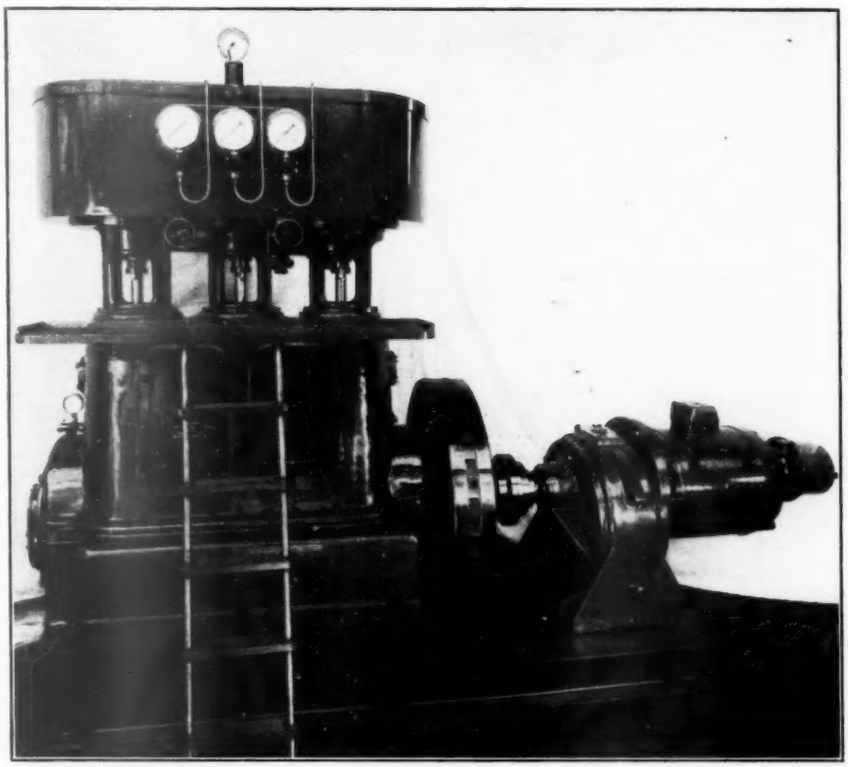


FIG. 10.—EXAMPLE OF AN ENGINE BUILT UP MAINLY FROM WELDINGS.

It is obviously not inferred that "weldings" can entirely supplant castings, but the business is growing, and will eventually prove beneficial to the founder. A good example of the welding together of a casting and forged material is shown in Fig. 11, which depicts an armature spider consisting of a seamless steel tube welded to a steel casting.

Intricate castings are sometimes made in sections and welded together to form a single unit, and sometimes it is an advantage to weld on lugs, bosses or pads which may cause trouble if cast integral with the castings. The welding of castings of pipe bends complete with flanges and the welding on of flanges alone is frequently carried out. Prolongations are sometimes better welded on to castings or even built up of all weld metal. The construction of complex apparatus by welding together castings and rolled material is not confined to the ferrous metals.

Fig. 12 shows a 6-ton capacity autoclave consisting of a 2-in. thick steel shell lined throughout with Monel metal, all joints in the lining being welded by the oxy-acetylene process. The heating pipes shown were all made of solid drawn Monel metal tubes, the stirring gear consisting of Monel metal castings mounted on a steel shaft sheathed with Monel metal sheet. This machine has operated at 250 lbs. per sq. in. pressure at 175 deg. C. for over two years.

Fig. 13 shows a water-cooled protector for use in connection with a glass-melting furnace, and is an example of two castings being welded together. The casting consists of Cronite, a nickel-chromium heat-resisting alloy, and the flange casting was attached to the ring casting by means of the oxy-acetylene process using cast Cronite filler rods.

X-ray examination of structures may be expected to play an important part in the development of welding as applied to the foundry industry. Its application will enable the foundryman to examine and comprehend the faults occurring in the castings he produces, and help with the alteration of design and technique, such alteration allowing of the combination of casting and welding to overcome the difficulties or bring about improvements and more reliable products.

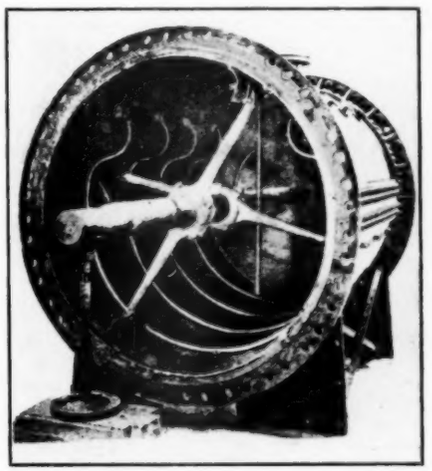


FIG. 12.—A 6-TON CAPACITY AUTOCLAVE LINED WITH MONEL METAL (COURTESY MONEL WEIR, LIMITED).

It is suggested that modern foundries could profitably adopt welding as an aid to their business, even though it may mean undertaking to supply composite articles consisting of castings and "weldings" for the convenience of customers, for however much the introduction of weldings to replace castings may affect the original business of the founder, it is futile to oppose it, as progress cannot be stayed.

Foundrymen already utilise the welding processes for the repair and adaptation of equipment to their requirements and the natural trend of modern progress indicates the path most profitable to follow to meet the modern demands for stronger, lighter and sometimes cheaper construction.

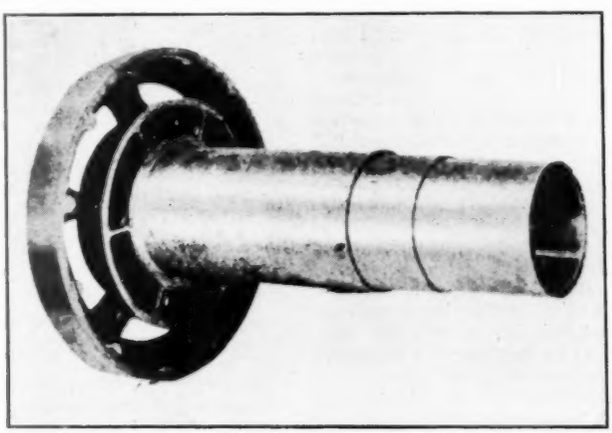


FIG. 11.—A COMPOSITE COMPONENT CONSISTING OF A STEEL CASTING WELDED TO A SEAMLESS TUBE.

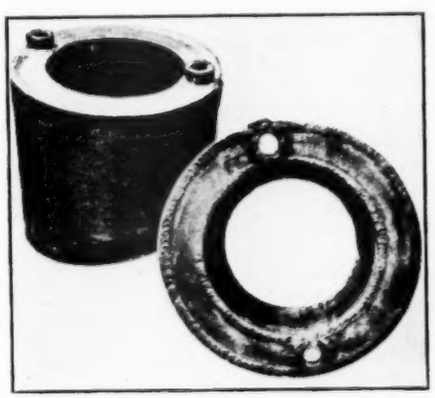


FIG. 13.—A WATER-COOLED PROTECTOR CASTING PROVIDES AN EXAMPLE OF TWO CASTINGS WELDED TOGETHER TO FORM ONE COMPONENT.

The authors desire to express their thanks to Mr. A. Stephenson for his valuable assistance and helpful criticism.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents]

Factors in the Economic Conduct of Vitreous Enamelling

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I was extremely interested to read the excellent article by Mr. J. H. Coupe, bearing the above title, published in your issue of December 27, 1934. There are, however, one or two points to which I would like to draw your readers' attention.

In the first place, Mr. Coupe, referring to his cupola practice, gives the total weight of pig-iron and scrap as 15 cwts. with a coke charge of 3 qrs. 20 lbs. This gives a metal/coke ratio of over 15 : 1, and as the majority of castings for enamelling are of a light, ornamental type, requiring fluid metal, this ratio is surprisingly high. My experience in the production of castings of this nature places the metal/coke ratio in the region of one-half of that stated, and, in view of this, it would be interesting to have further information regarding Mr. Coupe's cupola practice. The charge is stated to be for a 2-ton cupola, but with your permission, I would like to know its diameter, and the number of hours blown per day. In the case I have quoted the metal/coke ratio was 8 : 1, and the cupola blown from 8 a.m. until 6 p.m. daily, casting being practically continuous from 8.30 a.m. with one hour break for lunch. Fifty per cent. of the metal was for baths, the remainder for stove and grate parts, etc.

Passing to the actual enamelling operation, the author says "attempts are continually being made to produce a majolica effect with a liquid-spraying enamel. So far, these have not met with commercial success," but does not give any information as to why they are unsuccessful. Drawing again on past experience, I venture to offer the explanation that failure here is due to the fact that in order to spray successfully, an enamel must have a proportion of clay added at the mill to act as a "vehicle." This, in common with other mill additions, remains in suspension, and thereby also acts as an opacifier. Such an enamel is fatal to the production of the beautiful majolica effects desired, which can only be obtained by means of a truly transparent enamel, wherein everything must be in solution.

It would be interesting to know if Mr. Coupe has any recent experience in the production of leadless majolica enamels as mentioned in a previous article by the writer ("The Vitreous Enamelling of Cast Iron," FOUNDRY TRADE JOURNAL, February 12, 1931).

With regard to the question of cleaning castings, I agree entirely with Mr. Coupe that sand-blasting is definitely the best method of accomplishing this very important operation. I was, however, somewhat surprised to note that he is unable to obtain satisfactory results from chilled-steel abrasives without the addition of flint grit, and in the absence of other evidence, assume his experiments were made with either (1) round shot or (2) "soft" angular material. Round shot is, of course, quite unsuitable for this class of work owing to its action of "peening" the surface of the castings, whilst angular material, to be effective, must be extremely hard and brittle.

It came completely as a shock to read in your account of the discussion that Mr. Coupe is reported to have said that "two very large firms had changed over to steel shot only, and found that the acid-resisting properties of their enamels had disappeared." It is incomprehensible to me how the method of cleaning the castings can affect the acid-resisting properties of the enamel. In your report of the discussion, no explanation of this from Mr. Coupe was given. I suggest that the experience recorded is of such an extraordinary character that many others, besides myself, would be interested to learn Mr. Coupe's explanation or theories.

In conclusion, I would like to congratulate Mr. Coupe upon his valuable contribution to the literature of a very interesting and fascinating subject.—Yours, etc.,

J. H. D. BRADSHAW.

Bradley & Foster, Limited,
Darlaston, Staffs.

January 2, 1935.

The Oldest Grey-Iron Casting

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Mr. C. E. Williams' letter in your issue of December 20, 1934, raising the question of "What and where is the oldest piece of cast iron?" prompted me to visit the South Kensington Museum, where there are some very old fire-backs. The first thing I discovered, on examining these fire-backs, was that I did not feel they could have been produced by puddled or wrought iron. The next discovery was a fire-back dated 1584, about which there can be no doubt as to its being cast. It is quite obviously iron *poured* into a simple mould, made probably by pressing a simple box into sand and then producing ornamentation by the sand being still further pressed by single patterns. Its chief interest lies in the fact that the top of the casting shows that the metal flowed above the level of the casting proper, and produced what we should now call "flash," which has never been removed.

Secondly, I found one or two other fire-backs dated 1582, 1649, etc. I understand that *the earliest known fire-back in existence is at the Lewes Museum, which claims the date* 1406.

The most interesting thing which results from Mr. Williams' letter is a discovery that J. Starkie Gardener delivered a lecture on May 12, 1898, entitled "Iron Casting in the Weald" before the Society of Antiquaries. At that meeting he produced evidence to show that Henry Hogg had a personal interview with Henry VIII in 1543, and as a result he made a formal tender to the Court to supply all the King's cannon and grenades at a price of 10s. per cwt. I take it to be agreed that this means that at that date the art of casting had already become sufficiently advanced that at least one Sussex founder was producing sound castings which were not only cored, but perhaps also depended upon split moulds, as they are known to-day. I understand also, as a matter of topical interest, that in the following year (1544) there was some bother at Court, as the price for the title to Export Licence Holder of Arms had risen to a ridiculous figure, and there were some unpleasant comments from various Continental countries protesting against the traffic in armaments carried on by Great Britain.

There is no doubt whatever about these cannon and grenades being cast iron, and I hope to be able to procure reproductions or facsimiles of these export licences and the tender made by Hogg to Henry VIII.—Yours, etc.,

SYDNEY EVANS.

Engineers' Agents, Limited,
46, Victoria Street, London, S.W.1.
December 27, 1934.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—With reference to Mr. C. E. Williams' letter in THE FOUNDRY TRADE JOURNAL of December 20, 1934, while we are unable to vouch for the actual existence of iron castings of earlier dates than those mentioned by Mr. Williams, it seems extremely probable that fourteenth-century castings are still to be found on the Continent, if not in England. In the year-book of the City of Ghent, dated 1313, there is a reference to cast-iron cannon; while in 1377 cast-iron cannon were produced near Erfurtin Thuringia, Central Germany. There are also records of cast iron being produced in Sussex about 1350. Bearing in mind the durability of cast iron, it seems reasonable to assume that at least fragments of some of these early castings have survived.

Mr. Williams is correct in assuming that the earliest-known cast-iron pipes were those installed at Versailles between 1664 and 1668, some of which are still in use. The earliest cast-iron main now in existence in Great Britain is probably one which was laid in Edinburgh between 1704 and 1755. This 5-in. main still conveys water to the Castle Esplanade. There are numerous examples of late 18th-century and early 19th-century cast-iron mains which are still in service.

With regard to wooden pipes, it is interesting to note that mains consisting of bored pine logs are still in service in various parts of the United States. Similar mains were used in England from Roman times until the beginning of last century. These pipes were made of elm or coniferous timber, the bark being left on as a protective coating. They were often fitted with elm stop-cocks, and jointed with wrought-iron end-bands or collars. House connections were usually made with the aid of brass ferrules driven into holes bored into the pipes. The internal diameters of wooden pipes ranged from about 2 to 10 in. Their average life would not be more than about ten years.—Yours, etc.,

PERCY H. WILSON,
Foundry General Manager.
The Stanton Ironworks Company, Limited,
near Nottingham.
December 29, 1934.

World's Iron and Steel Production in 1934

The Verein deutscher Eisen- und Stahl-Industrieller have issued preliminary estimates of iron and steel output in the principal producing countries of the world, according to which pig-iron output was 62,300,000 metric tons, or 26 per cent. more than in 1933, and steel output 81,000,000 tons, or 18.4 per cent. more than in 1933. Compared with the peak year 1929, production in 1934 was at the rate of 63 per cent. for pig-iron and 66 per cent. for steel, as against 40 and 42 per cent. respectively in 1932. European production in 1934 was 41,500,000 tons of pig-iron and 49,500,000 tons of steel ingots and castings, representing increases of 30 and 24 per cent. respectively over 1933. The largest percentage increase took place in Germany, where pig-iron output advanced 66 per cent. and steel output 55 per cent. over the 1933 figures, while the increases in the Saar Territory were 16.9 and 15.6 per cent. respectively. In Russia, there has also been a marked advance in production, no less than 10,400,000 tons of pig-iron being produced during the year.

The principal steel producer in Europe was Germany, with 11,800,000 tons, followed by Great Britain with 9,280,000 metric tons, and Russia, including its Siberian furnaces, with 9,200,000 tons. France, where production was lower than in 1933, was the fourth largest steel producer in 1934 with 6,170,000 tons, followed at some distance by Belgium and Luxemburg with an output of 4,800,000 tons. Apart from the marked recovery in production in the United States, the most interesting development outside Europe is the sustained increase in Japanese iron and steel production to 2,300,000 tons of pig-iron and 3,570,000 tons of steel last year. All the foregoing figures are in metric tons.

Manganese Bronze

ADVANTAGES AND DRAWBACKS AS A FOUNDRY ALLOY

DISCUSSION

Few lectures presented to the London Branch of the Institute of British Foundrymen have evoked such an excellent discussion as that delivered by its Past-President, Mr. Wesley Lambert, C.B.E., on "Manganese Bronze." It was reported in full in our issue of December 13, 1934. Mr. A. S. Beech presided, and, in opening the discussion, recalled that the only practical experience he had had of the use of manganese bronze was in the making of gun-carriages during the war. The work was handed over to the foundry with which he was then associated by someone who had experienced a lot of trouble with it and wished to get rid of it. To the amazement of everyone concerned, however, the first casting made at his foundry was a good one; but the scrap resulting from the making of the remaining castings was, to say the very least, abnormal—and, needless to say, when they had completed the first order a repeat order was not accepted. In view of that experience, he had been glad to hear Mr. Lambert say that manganese bronze castings were not the most attractive castings from the foundry point of view.

DR. C. T. SMITHELLS (Chairman of the London Section of the Institute of Metals), commenting on Mr. Lambert's statement that manganese bronzes contained from traces to 5 per cent. of manganese, said that presumably manganese bronze containing only a trace of manganese was not very different from a brass. But he asked why the manganese conferred advantages on the bronze, what effect the manganese additions had as compared with the effects of additions of nickel, iron or any other metal, and whether it had any effect on the micro-structure or other properties by which one could recognise its presence.

Functions of Additions

MR. LAMBERT replied that the view generally held, until comparatively recently, as to the function of the various added metals was that manganese and silicon were deoxidisers of the copper, that iron and nickel were toughening elements, that tin was a corrosion-resisting specific, and that aluminium increased the fluidity of the alloy. On the whole, these findings, subject to slight qualifications, were not far wrong, inasmuch as the several elements did in a measure tend to act in the manner stated.

However, the influence of each of the metals named was more pronounced than the foregoing statement would indicate. Tin increased the corrosion resistance of the alpha and alpha-beta bronzes, but was not desirable in wholly beta bronzes, as it appeared to facilitate corrosive action in the latter type. For the alpha-beta high-tensile bronzes the Admiralty specified a tin content of not less than 1 per cent. Iron not only stiffened, but increased both the yield and the ultimate strength of an alloy owing to the grain-refining action of the iron on the alloy as a whole. Half of 1 per cent. of iron would give appreciable resistance to abrasive wear; alloys containing from 1 to 2 per cent. of iron offered considerable resistance to abrasive wear. In metal for locomotive axle boxes, for instance, it was not at all unusual to have an iron content up to 1½ per cent.

Manganese increased the incorrodibility of manganese bronze, possibly by the removal of oxide; it kept the grain size small, effected a more mixed orientation of the grains, and ensured better cohesion between neighbouring grains, thereby increasing both ultimate strength and ductility of the alloy. Aluminium was introduced as a deoxidiser, and as a substitutional element in part for zinc. In the latter capacity, aluminium served to ensure increased ductility and a larger reduction of area for a given breaking load, and also extended the range of temperature in which liability to fracture under stress occurred. Nickel toughened, increased the elastic limit and the ductility, but under certain conditions coarsened the segregate into local patches which were a source of weakness. Nickel and aluminium in the same alloy were not infrequently incompatible. The percentage proportion of the combined elements additional to copper and zinc in bronzes of the manganese bronze type rarely exceeded 8½ per cent.

It was difficult to detect under the microscope any of the additional elements, unless present in excess for a specific purpose. In this connection, Mr. Lambert again referred to manganese bronze for locomotive axle-boxes, where excess iron was added to give the alloy more resistance to abrasive wear. If an axle-box, made of manganese bronze containing up to 1½ to 2½ per cent. of iron, were to fracture and become exposed to the air, the fracture would become rusty within a very short time; one would hardly recognise it as manganese bronze, and if one examined the fracture under the microscope one would note the presence of iron. In the same way, with an excess of tin above about 1½ per cent., the copper-tin alloy would segregate out, and, inasmuch as that was a brittle alloy, it was certainly not conducive to strength in the alloy as a whole. But it could be accepted as a general statement that in the ordinary run of manganese bronzes the additional elements are not revealed under the microscope; they were in solid solution in the alpha and beta copper-zinc constituents.

Influence of Fuel

MR. JOHN CARTLAND, referring to the use of reverberatory furnaces, asked whether in Mr. Lambert's experience there was a greater tendency to the gassing of the metal (leading to unsoundness in the castings) when using oil firing than when using coal firing; and, if so, what precautions could be taken to avoid the gassing of the metal when using a direct oil flame.

MR. LAMBERT replied that he had had no personal experience of large oil-fired reverberatory furnaces; the reference he had made in the Paper to such furnaces related to the "open-pan system" used in America, whereby the oil was contained in shallow pans external to the furnace and was heated by Bunsen burners until it vaporised, the vapour being drawn by natural draft into the furnace, where it was ignited and combusted to afford the heat for melting. There did not appear to be any abnormal gassing of the metal under those conditions; but he would be inclined to think that the risk would be considerably greater if melting was effected in a large direct-fired injector-burner type of oil-fired reverberatory furnace.

What is Manganese Bronze?

MR. G. L. BAILEY was somewhat surprised by the variety of materials which Mr. Lambert included under the title "manganese bronze," a title which he did not much like because it was vague and general and rather misleading. He had always understood manganese bronze to be essentially a high-tensile brass, a brass of the alpha-plus-beta or beta structure, containing more or less a number of added elements, of which one was generally manganese. But Mr. Lambert had included a very wide variety of materials as manganese bronze. He had mentioned a naval brass, *i.e.*, the 60/40 brass containing 1 per cent. of tin; and he had also included a number of ductile alpha brasses which Mr. Bailey had not previously regarded as being covered by the term "manganese bronze." If the term covered such a wide variety of materials as Mr. Lambert had suggested, one wondered whether it would not be advisable to make some attempt to dispense with its use.

Manganese Bronze Defined

MR. LAMBERT quite appreciated the view expressed by Mr. Bailey, and said that the composition of commercial manganese bronzes would be found, in general, to be within the following limits:—Copper, 50 to 70 per cent.; aluminium, traces to 5 per cent.; tin, traces to 1½ per cent.; iron, traces to 2 per cent.; manganese, traces to 5 per cent.; nickel, traces to 3 per cent.; zinc, the remainder. At the same time, he did not wish to infer that a manganese bronze necessarily contained all these elements. Naval brass could not be considered to be a manganese bronze. The latter was a very much more complex brass than a straight brass, to which only one additional element was purposely added. The average composition of a manganese bronze having a tensile strength of 50 tons per sq. in. as-cast was:—Copper, 61.5 per cent.; zinc, 30 per cent.; aluminium, 5 per cent.; manganese, 2 per cent.; iron, 1½ per cent. One could not regard that as being in the same category as naval brass.

Cored Structure in Beta Brass

MR. HARRIS, commenting on Mr. Lambert's statement that a cored structure was not observed in beta brass, said that although it was not common, it was not unknown, and he personally had seen it in beta brass. There was a small area of solid solution above the actual beta area itself. The maximum range of crystals was about 10 to 20 degrees, and if cooling were slow enough one would expect a cored structure, which could be detected by a deep etching with Rosenhain's ferric chloride; but with ordinary cooling and etching one could not detect it. He did not know whether that structure had an effect on the mechanical properties of beta brass, but he imagined even slight annealing would remove it.

MR. LAMBERT confirmed that occasionally there was slight evidence of the cored structure in beta brass. His Paper, however, referred more to the manganese bronzes generally met with in commercial practice, and in those he had never been able to detect convincing evidence of a cored structure in the beta.

MR. H. O. SLATER (Past-President of the London Branch, Institute of British Foundrymen) related a recent experience, concerning the casting of manganese bronze billets for rolling, which confirmed Mr. Lambert's reference to the importance of covering the mould. At first he had tried casting the billets in an open iron mould, but without success. He had succeeded, however, by casting chills with a sand head on top, and a runner, and with a cup about one-third of the weight of the casting; the metal was teemed in so that the cup was full. The sand kept the metal hot at the top and the cup kept the head hot, and the castings produced were perfectly sound; they had very high tensile strength and met the specification.

MR. LAMBERT said that Mr. Slater's remarks served to emphasise the point made in the Paper as to the necessity of using big feeding heads and keeping the metal hot, so that the casting could be satisfied and there was sufficient fluid metal to follow up the liquid contraction as cooling proceeded.

Perhaps the Paper had led the meeting to believe that manganese bronze was not a very desirable metal in the foundry. But it was a very useful metal and was in constant demand for such important castings as propellers. During the period in which he was head of the metallurgical department of Messrs. J. Stone & Company he had supervised the melting of something like 50,000 tons of manganese bronze. So that, although manganese bronze entailed

some casting difficulties, it must not be imagined that it was not a desirable metal; on the contrary, it was a very desirable metal, but he had drawn attention in the Paper to certain fundamental facts to be taken into consideration when producing castings. Mr. Slater had overcome his difficulty in the casting of billets by providing a good open feeding head. In casting a large propeller such as would be used on the s.s. "Majestic" or other vessels of that character, such propellers having a finished weight of 16 or 18 tons, the casting head would weigh about 4½ *tons*. After the teeming of the actual propeller casting, additional hot metal was poured in at the top of the mould to form the feeding head.

DR. S. W. SMITH (Past-Chairman of the London Section, Institute of Metals) asked whether, in the case of the alloys dealt with in the Paper, special precautions were necessary to protect the stream of metal during pouring. Some years ago he had had some experience of alloys of the silver-copper series containing manganese, and it was to be essential, in making strip castings, to surround the stream of metal with a gas flame during pouring; otherwise, the metal scummed immediately. Mr. Lambert had mentioned the necessity for skimming the metal carefully before pouring. Did this imply that some special precautions were necessary when one departed from the ordinary copper-zinc alloys to those containing manganese?

Another difficulty which had been encountered was the increased susceptibility of the crucibles to corrosion and slagging when the alloys contained manganese.

MR. LAMBERT said that Dr. Smith had prompted the reply to his own question. Manganese bronze was essentially a copper-zinc alloy, and the zinc fume protected the stream of metal from atmospheric effects. In the Paper he had referred to the casting box being placed over the mould and to a constant stream of metal from the casting box into the mould; inasmuch as it was sealed at the top, there was not much possibility of air getting to it. When pouring direct from crucibles one should bring the lip of the crucible as near as possible to the mould; it should be poured with as little turbulence as possible.

He had not experienced the corrosion of metal moulds when handling manganese bronze of the ordinary kinds, which contained only up to 2 per cent. of manganese; but he had heard of manganese bronzes containing as much as 8 per cent. of manganese, and it was not unlikely, if one teemed such an alloy into a mould, that it would have some effect upon the mould.

MR. SLATER asked Dr. Smith whether he had found advantage in using a gas flame, say, over the runner, so that the metal should not pick up gases from the air.

DR. SMITH said he had been speaking of pouring direct from the crucible into a chill mould and not through a dozzle or gate, but there was no doubt there is a very great advantage in having a very plentiful supply of gas round the stream in the case of such alloys, containing manganese, as he had referred to.

Well-Balanced Alloys

MR. J. E. NEWSON, commenting upon the author's reference to a "well-balanced" alloy and the statement that the various constituents did not appear in the micro-structure, asked whether a "well-balanced" alloy would be one in which there was no excess hardener because in a complex alloy containing more than 0.5 per cent. of iron a separate constituent appears, known as the "blue etching" constituent—a very general term.

Another question was whether there was any value in re-melting manganese bronze; *i.e.*, when the metal was first made, was it essential to make it in ingot form and then re-melt for casting, and were the tensile properties affected by repeated re-melting—always assuming, of course, that the melting operation was carried out under proper control?

Commenting on Mr. Slater's remark that in casting manganese-bronze billets it was necessary to use a sand head to ensure soundness, Mr. Newson said that his long experience of casting billets in this alloy for forging and extruding, as well as strips for rolling, he had never found it necessary to apply a sand head. It was of great importance, however, to control the pouring speed and to follow up by feeding with fresh hot metal, in order to obtain perfectly sound billets or strips.

Development of "Balance"

MR. LAMBERT recalled his reference to aluminium and nickel as being almost incompatible in some alloys; an alloy in which those metals were present in such form as to be incompatible would not be considered a well-balanced alloy. One must find out by experience which metals could be added, and in what quantities, their reactions one upon the other and their relation to the copper-zinc portion of the alloy as a whole. That matter came peculiarly within the province of the metallurgist, and it was a costly matter, involving many experiments. Those who were not closely concerned with the development of manganese bronze could have no idea of the hundreds of experiments on a large scale, each involving the use of a quantity of metal never less than 280 lbs., which had been carried out in order to bring that development to its present stage. That would give some idea of the amount of private research carried out at works, in addition to that carried out by research institutions; the latter could never do the work on the scale applied in the works. Although one sometimes heard a works metallurgist described as a process metallurgist, if he were worth his money he was as much a research metallurgist as any of those in research institutions or university laboratories.

He certainly did not consider it desirable to compound metal and cast direct; one should ingot the metal first and melt again.

Repeated Meltings

As to repeated re-melting, he said that if the melting was carried out under controlled conditions, and provided the necessary additions were made to compensate for melting losses, the metal would not be harmed. As the result of re-melting there would be losses of certain elements, particularly zinc, and unless one made compensating additions one could not expect the manganese bronze which had been re-melted repeatedly to be of the same character as the original. If he owned a yacht and wanted a propeller for it, he would prefer that it should be made from an Admiralty returned propeller rather than from new ingot metal.

There was a great deal in controlling the speed of billet pouring. Manganese bronze was a very hungry metal; if one cast a billet, say, 4 in. in dia. and 18 in. long, and did not adopt the best pouring speed and conditions, and if one allowed it to cool out without adding feeding metal, one would probably be able to get a pencil, or something of that sort, down to the extent of 6 in. or 7 in., when quite cold. On the other hand, by proper pouring one could enable it to become solid practically as it was poured, so that it would not be so hungry as it would be if the metal were merely flopped in without making provision for feeding.

MR. A. H. MUNDEY (Past-Chairman of the London Section of the Institute of Metals) proposed a vote of thanks to Mr. Lambert, as an old friend and colleague. He recalled the first analysis of manganese bronze at the Royal Arsenal—before he had become associated with that organisation. Samples were submitted to two laboratories, and it was reported by one that the metal contained no manganese whatever; the report from the Arsenal laboratory indicated that it contained only a trace. Undoubtedly, however, the manganese had been put in, although the quantity was small; it was intended as a deoxidiser. The manganese was practically undetectable.

Discussing the corrosion of containers used for manganese alloys, Mr. Mundey recalled an occasion on which some young men had attempted to make eccentric alloys, one of which contained 17 per cent. of manganese. The corrosion in that case was so bad that it had cut the crucible in half at the slag line.

Emphasising the value of manganese bronze to this country, particularly during the war, he said he did not know what we could have done then had we not available such a non-ferrous alloy, as strong as steel, capable of being cast, and giving such extraordinary results, particularly for gun carriages. He remembered having seen cradles which had been returned from the field having their manganese-bronze wings twisted and bent in an extraordinary manner as the result of having been struck by shells. No metal other than manganese bronze and mild steel could have withstood that treatment without breaking, and it had rendered wonderful service. But there had been difficulty in persuading people to make manganese-bronze castings for the authorities during the war; he had visited many foundries in London and other places, but the founders would not accept the work, for they were not accustomed to it. One of the difficulties in connection with the production of manganese-bronze castings in foundries in which they had not been made previously was that those responsible for getting out the quantities of materials did not realise what large heads, risers and runners were required; when a 1-cwt. casting required half a cwt. of surplus material they had held up their hands in horror. But such quantities were required, and there had been quite a lot of quarrels between the purchasing and production sides before they had been educated sufficiently to meet the necessities of the case.

MR. MURPHY, seconding the vote of thanks, said the fact that something over 50,000 tons of manganese bronze had passed through Mr. Lambert's hands, made one realise what a great part he had played in the development of this material. In his Paper he had given an account of the early history of manganese bronze; if he had continued the historical treatment up to a more recent date it would have become clear how much he had had to do with the making of that history.

The vote of thanks was carried with enthusiasm.

MR. LAMBERT, in a brief response, said that this was the first occasion on which he had essayed to present a Paper wholly on manganese bronze, and he had wondered whether it would be of sufficient interest, inasmuch as it was not in common use in the majority of foundries throughout the country, nor had the majority of metallurgists had very much to do with it. But the discussion justified his hopes that the Paper would be of interest to both the foundrymen and the metallurgists, and it had been a source of great pleasure to him to present it.

At the conclusion of the meeting, DR. SMITHELLS, on behalf of the London Section of the Institute of Metals, thanked the London Branch of the Institute of British Foundrymen for its hospitality and for having secured from Mr. Lambert a Paper on an aspect of industry which some were likely to neglect.

MR. BEECH briefly responded, and the meeting closed.

The Farington Steel Foundry

We regret that we were somewhat premature in announcing the closing down of the Farington Steel Foundry, as this is not to take place until April, when the ironfoundry will occupy the space now taken up by steel castings. We apologise very sincerely for any inconvenience our statement may have caused.

Steels for Die-Casting Dies

SELECTION AND TESTING METHODS

MR. SAM TOUR, in the course of an article in a recent issue of "Heat-Treating and Forging," states that some years ago he described heat checks or thermal cracks that occur in die-casting dies. The life of dies was considered in relation to the casting temperature, the material used for the die, and the heat to be absorbed by the die per unit volume of casting made. The mechanism of the action that results in thermal failure of dies was described. In the present Paper the author proposes to describe some additional observations in regard to heat checking, make one or two suggestions as to the method or methods for further investigation of the problem, and give the results obtained on some work carried out along these lines.

Importance of Heat Checking

Heat checks in steel are the source of trouble in many industries besides that of die casting. Every shop where metals are subjected to hot-working is searching for improvement and hoping for a cure. The development of a material of sufficient strength to be used as a die and yet devoid of the property of heat checking would be a boon to many shops and many industries. The need for thorough study and research on the subject is evidenced by the wide variety of hot-working die steels on the market. It is peculiar, but true, that in practically every case the maker of the steel can give concrete evidence to prove his contention that his type of hot-working die steel is as good as or better than any other. A number of steel companies have several hot-working die steels from which choice can be made to fit a particular set of requirements. Possibly to expect one material to be universally the best hot-working die steel is unreasonable. In some hot-working operations, as in drop forging, the die must have great roughness to withstand the stresses developed; in other operations, as in hot piercing or punching, resistance to erosion at high temperatures, possibly defined as strength and hardness at elevated temperatures, is required. Still in others, as in die casting, only sufficient hardness to resist scoring between moving surfaces is required, whereas the resistance to sudden changes in temperature must be at a maximum.

Formation of Heat Checks

Heat checks, in the author's opinion, are due to strains set up by repeated changes in temperature, and these strains, at some time or other, set up stresses that exceed the elastic limit or fatigue limit of the material in question. The amount of strain is a function of the difference in temperatures between two adjacent parts of the same block of steel; in other words, the temperature gradient. Assuming that the modulus of elasticity of steel is approximately independent of composition, the following properties should be sought for in the effort to obtain a steel with maximum resistance to heat checking:—(1) Minimum coefficient of expansion; (2) maximum thermal conductivity; (3) maximum elastic limit; and (4) maximum endurance limit.

If one considers that the stresses are developed rapidly by sudden heating, one must also bear in mind that the application of stress has somewhat the nature of an impact, and one must, therefore, add a high-impact value to the list of the desirable qualities of a die steel. In most cases the die, during operation, becomes hot. One must, therefore, consider all of these properties from the standpoint of this temperature. In other words, the desired high-elastic limit and the desired high-impact strength, etc., should be at the elevated temperatures.

Work by the General Electric Company has indicated clearly that there is a relation between the results of notched-bar impact tests and those of notched-bar fatigue tests. Two pieces of steel apparently identical as rated by tensile strength, hardness, elongation, reduction of area and unnotched impact strength may have widely different notched-bar fatigue resistances, and, when they do, they also have widely different notched-bar impact strengths. The General Electric work shows this on both Izod and Charpy types of impact tests.

Requirements of a Steel for Die-Casting Dies

From the practical standpoint of the user—the die-casting company—the requirements for a steel for dies for casting aluminium, for example, can be listed as follow:—(1) Machinability; (2) stability in heat-treatment; (3) resistance to heat checking; (4) resistance to deformation, battering, etc., *i.e.*, hardness; (5) resistance to cleavage cracking on sudden heating or cooling, *i.e.*, toughness; (6) resistance to erosive and solvent action of molten aluminium; (7) cleanliness and uniformity; (8) cost, producibility, forgeability, etc.; and (9) properties at elevated temperatures.

Machinability.—From the standpoint of machinability, chrome-vanadium steel seems to be quite satisfactory. Hot-working tungsten steels are much more difficult to machine than the chrome-vanadium steels, and are considered just barely passable in the die-casting industry to-day. Austenitic steels, in general, are out of the question. Possibly the austenitic steels could be made more machinable by the addition of zirconium sulphide, or something of that nature, but it is doubtful whether, even if this could be done, the steels would be suitable for die-casting dies.

Stability in Heat-Treatment.—The standard chrome-vanadium steel used for many years for dies is not satisfactory, because of its tendency to warp, grow, shrink and crack during the heat-treating process. The tungsten-chromium type of air-hardening die steels are all quite satisfactory from the standpoint of stability in heat-treatment. The tungsten-chromium type of oil-hardening die steels are somewhat dangerous, inasmuch as it is common practice in the manufacturing of die-casting dies to have blocks cut up with very heavy sections next to very thin sections, and with sharp corners between the two, and a steel that requires oil quenching is liable to crack at these weak points. In general, it seems as though the air-hardening type of steel, whether it contains tungsten or not, is preferable for general purposes.

Resistance to Heat Checking.—The failure by heat checking of die blocks of any one steel seems, to some extent, to be a function of the hardness. In practically all steels tested or used, die life seems to be determined, so far as heat checking is concerned, by the initial hardness. Up to the point where insufficient toughness remains in the steel, it seems to be true that the harder the block the longer it will stand up. As the hardness increases there is a gradual and characteristic change in the type or configuration of the heat checks. Hardness, however, is not alone the entire answer, as is indicated by the fact that plain carbon steels of 400 Brinell are inferior to chrome-vanadium steel of the same Brinell hardness. Also, chrome-vanadium steel of 430 Brinell is inferior to chrome-tungsten steel of the same Brinell hardness.

Hardness.—Apart from the relation of hardness to resistance to heat checking, there is required a certain amount of hardness in any block, for service reasons. Dies are made up of moving parts, slides, cores, pins, etc., and usually are hot when in operation. All die parts must be hard enough so that excessive rubbing and scoring and eventual seizing of the parts do not occur. It is possible to have soft main or stationary blocks in a die and hardened moving pieces, but it is preferable to have all the main parts of the die made of the same steel and hardened. Moving parts can be left a bit harder than the stationary parts. All blocks should be hard enough to resist defacement or deformation due to the powerful closing action of the machines when stray pieces of metal are accidentally caught somewhere on the parting faces of the die. About 325 Brinell hardness is as low as is permissible for main blocks in this connection. From the standpoint of resistance to heat checking, the minimum hardness is considerably above 325. For example, it has been found that the hot-working die steels of the chrome-tungsten type develop heat checking rapidly at a Brinell hardness around 325 and at such hardnesses are apparently inferior to chrome-vanadium steel, whereas if the two steels are compared at Brinell hardnesses of 430 the chrome-tungsten steels are superior to chrome-vanadium steels.

Cleavage Cracking.—This is a difficulty that is not at all serious in the chrome-vanadium steels except when they are left at a Brinell hardness of above 477. In the chrome-tungsten steels cleavage cracking is a serious problem and does not seem to have much relation to the Brinell hardness of the block of steel, but seems to be more closely associated with its macrostructure. Some chrome-tungsten blocks develop serious cleavage cracks at hardnesses as low as 340 Brinell, whereas others of the same analysis do not develop such cracks even at hardnesses as high as 477. In most cases where serious cleavages occur in chrome-tungsten steel the fracture shows evidence of a fish-scale or a marble structure. As this structure is usually associated with brittleness, it would seem that cleavage cracking is a function of brittleness. The most promising test for this is the notched-bar impact test, and it seems that a steel of a high-impact strength at the hardness at which it is to be used is least subject to cleavage cracking.

Erosive and Solvent Action of Molten Aluminium.—Erosion and solvent or soldering action of molten aluminium and its alloys on the die steels are apt to occur at the gates, where the aluminium is at maximum temperature and is made to travel at high velocities across the steel, thus eroding and attacking the steel. A thin oxide layer or an applied layer of graphite prevents this solution attack if the layer can be kept in place and withstand the erosive action of the stream of metal. This erosive action sometimes becomes severe where the molten metal impinges directly upon a steel surface. Resistance of the steel to solvent action is therefore to be preferred although this matter should not be considered of major importance. For years statements have been made that nickel steels are not suitable for dies for aluminium die casting, because of this solvent action. That this is not true is indicated by the promising results obtained by the author some years ago on several steels containing up to 5 per cent. of nickel. The nature of the surface seems to be more important than the composition of the base.

Cleanliness and Uniformity.—Cleanliness and uniformity of a die steel are essential. Segregations and non-metallic inclusions are starting points for thermal fatigue failures and cleavage cracking. Segregations appearing as hard spots cause great difficulties in die sinking. Internal seams, slits, cracks and other defects must not be encountered at or near the base of a die impression after the greater part of the die sinking has been done. Ample top and bottom discards must be taken from the ingot. Ingots and ingot moulds and teeming practice must be regulated to avoid secondary piping, slag inclusions, oxide inclusions, etc. Heating, forging and annealing must eliminate all ingotism and develop uniform

structure throughout the section of the finished piece, and must not develop seams, cracks, hammer bursts or other defects.

Cost.—The finished steel for dies for aluminium die casting must be producible at a reasonable price not only from the standpoint of cost of ingredients but also from the standpoint of manufacturing costs in connection with melting, pouring, cogging, discards, chipping, annealing, forging, etc. It seems as though the die-casting trade will stand prices up to 40 cents per lb. but not much above that figure, and desires prices considerably below that.

Properties at Elevated Temperatures.—In service, dies for casting aluminium are subjected to temperatures from room temperatures or lower (cooling-water temperatures) up to 425 or 480 deg. C. or possibly higher. Small uncooled parts, for example, near the gate and almost completely surrounded by the aluminium casting, may conceivably become heated almost to the temperature of the incoming metal. Casting temperatures in die casting of aluminium range from 605 to 760 deg. C., with the average temperature possibly in the range from 650 to 675 deg. C. It is, of course, conceivable that in many cases the surface layers of the die steel, before the body of the blocks of steel can conduct the heat away, become heated to a red heat. For this reason, therefore, red hardness seems to be a desirable property for a die-casting die steel. It is also important that the steel maintain a relatively high-elastic limit and impact strength at these elevated temperatures. In other words, the elastic limit and impact-strength curves should preferably have no low areas or inverse deflections from room temperature up to, say, 540 deg. C.

Methods of Testing Proposed New Die Steels in Die-Casting Plants

In plants where the centre-gate die-casting machine is used there is a standard part known as the gate former or gate bushing. In these plants often new die steels are tested by making up a few gate formers. The author has tried out many different kinds of proposed die steel in this way. Another method of testing a proposed new steel is to insert a block of it in a die. This is common practice in plants that use the split-gate type of machine, which has no gate former. The difficulty in this type of testing is that when a special block is inserted in a given die it is necessary to wait until the die-casting company's customer who owns the die orders a sufficient number of castings to show the actual service the steel will render. This often takes years, and sometimes can never be accomplished because the customer changes his design or his source of supply or discontinues the part.

Another common practice is to use the new steel in the form of a sprue cutter or splitter pin. This is the gate post in many dies on the centre-gate machine, and takes the full force of the incoming metal. In most cases these splitter pins are not very carefully machined, are not held to close dimensions because they do not form a part of the finished casting, are not water-cooled, and are not given close attention. In general, it is difficult to obtain any important information in tests of sprue cutters, except from the standpoint of the soldering action of the aluminium on the proposed die steel. Even this is sometimes at fault because often it is desirable to have the metal stick to the sprue cutters to some extent, and no effort is made to keep the sprue cutter coated with graphite and oil to prevent the solvent action. If the sprue cutter were a part of the die, the attention given it would be entirely different, and possibly the net result on the steel would differ considerably.

A method of testing sometimes used is known as "total immersion." A block, for instance a 2-in. cube, of the proposed die steel is dropped into a molten bath of aluminium together with a similar block of a known steel and allowed to remain in the molten aluminium for a number of days. When it is taken out the aluminium is cleaned off as well as possible and the weight losses are determined. This is truly a solvent-action test and therefore is not indicative of what the steel might do in resisting heat checking. It is well known that cast iron is much less soluble than steel in molten aluminium; therefore, although cast iron is not a suitable material for die-casting dies for aluminium, it stands up much better than any of the standard die steels in this total-immersion test. It is interesting to note, however, that one or two special steels have seemed to stand up better in aluminium dies than chrome-vanadium, and also to have less tendency to go into solution in molten aluminium in this total-immersion test than chrome-vanadium steel. It is the author's belief, however, that these results are not important and that normally the total-immersion test is not of much value in evaluating different proposed die steels.

A proposed method for testing new die steels might be termed the "alternate-immersion method" with water cooling. In this test the samples of die steel are mounted on a crank arm so as to be alternately dipped into and taken out of a bath of molten aluminium eight or ten times per minute. The specimens are drilled so that water may be circulated through them to maintain them at a fairly low temperature. A counter on the crank arm makes it possible to determine the total number of cycles gone through until the time that heat checking begins to appear. Ten or twelve different steels can be tested at once in this manner. The test is not a duplication of the conditions in a die-casting die, because the molten metal does not strike the specimens as suddenly and the contact between the molten metal and the steel is not as intimate as when the molten metal is forced against the steel under considerable pressure and with considerable velocity.

Methods of Laboratory Testing

A die-casting company wants to know a number of things about a new steel before putting it to a test in service. This information should be supplied by the mill proposing the steel, and can be determined by laboratory methods of testing, somewhat as follows:—

The various transformations occurring in the steel upon heating and cooling are first to be determined, which can be done easily by the use of a Rockwell dilatometer furnace. From the transformations on heating and cooling as shown by the dilatometer curves the proper heat-treatment temperatures for the proposed steel can be selected. From a heat-treating standpoint it is desirable next to know whether or not small and large pieces of the steel will heat-treat at the same temperature or whether higher temperatures will be required for the large pieces. In other words, the depth of hardening of the steel is to be determined, and this usually is done by the heat-treatment of a small piece and a large piece simultaneously and checking up the finished hardness of the pieces. In this, of course, it is to be remembered that small pieces do not have to be soaked at temperature as long as the large pieces, but the actual temperature should be the same irrespective of the size of the piece.

The next thing to determine is the amount of dimensional change occurring in the steel as a result of various heat-treatments. This can be carried out by the actual heat-treating of U-shaped blocks of steel. Such blocks of steel as machined up are carefully measured, then given the quenching treatment as determined by the previous test; again carefully measured, then drawn and again measured; completely annealed and again measured, then rehardened and again measured, and, finally, drawn again and measured.

Other laboratory tests to be carried out are Brinell hardness, tensile strength and elastic limit, and notched-bar impact tests at room temperature and at 93, 175, 260, 345 and 427 deg. C.

Activities of C. A. Parsons in 1934

In a review of their activities during 1934, Messrs. C. A. Parsons & Company, Limited, state that during the year the Heaton Works enjoyed a considerable activity, a substantial volume of orders being received, not only for complete turbo-generating units, but also for turbine blading, transformers of all kinds, and other specialities of the firm With regard to the turbo-generating plants, the sizes of individual machines covered a wide range. The largest of these machines were destined for service in this country, but South Africa, Australia, Canada, India and China all placed orders with the Heaton Works for units of greater or less importance during the year. The largest turbines for which orders were received during 1934 were the two machines for the City of Birmingham, each rated at 51,500 kw. at 1,500 r.p.m. These will be of the two-cylinder tandem type, with single-flow low-pressure cylinders, similar to the 50,000-kw. machines at Dunston. For industrial purposes, two turbo-alternators of a very special character were completed and put to work during the year. Both were designed for testing switchgear, the larger of the two being supplied to Messrs. Reyrolle's Testing Station at Hebburn-on-Tyne. This alternator, the second of the kind to be built for Messrs Reyrolle, has a maximum short-circuit capacity of no less than 1,500,000 k.v.a., and will give this output at 22,000, 12,700, 11,000 or 6,350 volts, according to the connection of the windings. The other machine was constructed for the Laboratories of the N.V. tot Keuring von Electrotechnische Materiaten, at Arnhem, Holland. It has an output of 900,000 k.v.a. at 11,000, 6,350, 5,500 or 3,200 volts. An order was also received for a turbo-generator of 15,000 kw. from the Imperial Chemical Industries, Limited.

The transformer department of the Heaton works has been extended considerably during the year in order to cope with the increasing business. Many large transformers have been supplied, including several 15,000-k.v.a. at 66 k.v. for service in connection with the Grid, and a bank of 30,000-k.v.a. capacity for supplying the plant and furnaces of Messrs. Thomas Firth & John Brown's steelworks at Sheffield. The second set of transformers for Messrs. Reyrolle's switchgear testing station has now been put into commission, bringing up the total capacity of their bank of testing transformers to 1,500,000 k.v.a. at 132,000 volts. An automatic "on load" tap-changing gear has been developed by Messrs. Parsons, and a number of transformers are now being fitted with it.

In the turbo-blower and compressor department, the most important machine completed during the year has been a large multi-stage compressor capable of delivering 900,000 cub. ft. of gas per hour at a gauge pressure of 140 lbs. per sq. in. The machine comprises a high- and a low-pressure cylinder in tandem, and is fitted with stage intercoolers integral with the lower halves of each cylinder. The compressor, which has now successfully passed its tests, has been built to the order of a British works.

The welding department has been kept busy during the year. Its output consists largely of such parts as alternator stator frames, condenser shells, bedplates and so on, but structural work is also undertaken.

Rubber Cement

Rubber cement, sprayed on the mould surfaces, is used in the making of fine bronze castings. The method has been found to give firm adhesion of fine surface particles and assures accurate reproduction of the details of the casting. Economy in handling of moulds, as well as excellent quality castings, are reported. This method also permits casting of bronze in greens and moulds.

The German Iron Foundries in 1934

By Th. Geilenkirchen, Dr.-ing. (Director of the German Foundry Employers' Federation)

The economic position of the German iron-foundries became very much better during 1934, in conformity with the undeniable all-round improvement in German industries. Thanks to the purposeful and unflagging efforts of the German Government, it has been possible within the first two years after the national revolution to reduce the number of unemployed from over 6 millions to 1¾ millions. And although it will still be the most imperative task for the immediate future to provide work and bread also for these unemployed, the success already achieved has resulted in a substantial reduction of the burdens on the State finances, not only by the saving effected in unemployment relief, but also by the recovery of tax-paying power on the part of the re-employed and of the industries which are again showing a profit.

Owing to these economies and recovered taxes, the Reich budget showed a total reduction of 6 milliard marks, without necessitating further calls upon the taxpayer. On the contrary, it was possible, by the reduction of various kinds of taxes, to lighten the burden on industry. By these measures, as also by the systematic encouragement of various key industries and the provision of facilities for carrying out a number of works of public utility, a considerable impetus was given to industry as a whole, the effect of which was naturally felt in the engineering works and the ironfoundries supplying them.

If the National Socialist Government also made use of the means so frequently suggested formerly and repeatedly, but unsuccessfully, applied by its predecessors, *i.e.*, endeavouring to stimulate industry by the placing of public-work contracts, it was at the same time fully aware that any really effective help could only be evolved from the industries themselves, and that public contracts would lead to success only provided that no restrictions were placed on the activities of the industries and that they were freed from the heavy burdens imposed on them by the former system. This was the standpoint invariably considered by the Government in all its measures, and the results have proved that it was right.

Automobile Industry

The automobile industry in particular was afforded the greatest facilities by the reduction of the high taxes on motor vehicles, as well as by the construction of motor roads on a large scale, so that its capacity was fully utilised, and even now, when a heavy seasonal decline was naturally to be expected, it still has plenty of work. Consequently, the foundries supplying the automobile industry have to record considerable orders for a long time to come. Moreover, the favourable position of employment in the automobile factories is reflected in other branches of engineering, especially in the machine-tool industry, and these orders partly make up for the lack of foreign orders. Nevertheless, it must be emphasised that the falling off in orders from abroad represents the crux of the entire economic situation in Germany, even though the German engineering branch has succeeded in retaining the relatively largest proportion of the exports, as compared with other industries.

The large-scale construction of motor roads has had a highly-favourable influence on hydraulic and structural engineers, as also on those firms constructing machinery for road-making purposes, together with the industries supplying them, among which the ironfoundries are included. The municipalities and a large number of private undertakings which had in the last few years been prevented from carrying out urgently-necessary work owing to the general lack of capital, have now, thanks to the all-round improvement in industry and the long-term credit policy of the Reichsbank, been enabled to place contracts for such work. Another factor which helped to bring about this happy result was the legal regulations providing for tax exemption in respect of new plant and equipment, particularly of short-lived machinery, according to which the expenditure effected for this purpose may be written off in full in the same year as the purchase, the full amount being therefore tax free.

Renovation of House Property

This last measure has benefited not only industrial undertakings but also all house-property owners, who have thereby been afforded facilities for repairing and restoring houses which in some cases had been greatly neglected and for providing modern equipment. Thus, as regards the provision of modern heating and sanitary equipment for a large number of dwellings which had hitherto been without such conveniences, the measure in question has had a direct effect on the foundries, which have obtained unusually large orders for boilers and radiators, as well as enamel castings for sanitation purposes. The result of the regulations for encouraging marriage by the granting of loans has been not only to release jobs hitherto held by female labour in industry but also to create an increased demand for flats and household articles, whereby the light-castings foundries have benefited. The sewage works which many of the municipalities were now enabled to carry out have considerably increased the sales of the pressure and effluent pipe foundries, as also those of the producers of castings for drainage purposes.

As a result of all these factors favourably affecting the industry, the employment figures for the foundries show a substantial increase all along the line. Whereas at the end of 1932 the average was round about 28 per cent., it rose to nearly 40 per cent. during 1933. In 1934 a large number of foundries were working at their full normal capacity and in some cases even over and above this, while other factories which, owing to unfavourable circumstances, were unable to participate in the revival, still showed 30 per cent. employment. The general average, however, is already between 55 and 60 per cent., a figure which may certainly be regarded as satisfactory.

Selling Prices Too Low

Unfortunately, this considerable improvement in the employment figures is not yet reflected in an improvement in prices, because both the Government and the associations responsible for price policy have been earnestly endeavouring to avoid any general rise in prices. In most cases, therefore, the foundries have had to be satisfied with the fact that the overhead charges, which under the stress of the years of the crisis had already been reduced to the lowest conceivable level, were now distributed over a considerably greater output—in many cases double that of the previous year—so that it was possible gradually to bring the prime costs into harmony with the selling prices obtained. In so far as this has not been done, it will be the primary task in the further economic development to effect an improvement in prices in cases where under the present conditions they are still below the prime cost. One may, however, even now count upon the fact that the future existence of the great majority of the foundries which have succeeded in weathering the storms of the years of crisis is assured under modest conditions.

The New Political Organisation

In addition to the politico-commercial development described above, the entire German industry, including all the foundries, has been brought within the scope of the efforts for the reorganisation of industry on an economic basis on the lines of the national-socialistic conception of economy. Whereas in former years industry, like agriculture, trade and commerce, had been united in appropriate economic associations for the representation of joint economic interests on a voluntary basis, the members of the various branches of industry have now been organised in State-recognised special groups, which are now alone authorised to represent them. All the German foundries have accordingly been united in a new economic "Foundries" group, divided into special sections, viz., iron foundries, malleable-iron foundries, steel foundries and non-ferrous foundries, and further sub-sections. These special groups are not, however, permitted to deal with questions of price and marketing policy, these being reserved for the associations previously existing, *i.e.*, for the Verein Deutscher Eisengiessereien (German Foundries' Association), as regards the iron foundries, and for the Verein Deutscher Stahlformgiessereien (German Steel Foundries' Association) as regards the steel foundries, etc.

Unified Castings

As far back as 1919 the Verein Deutscher Eisengiessereien drew up a costing system for castings in the so-called Harzburg memorandum, which enables the prime cost of all classes of castings to be determined according to uniform guiding lines; from these the selling prices are then calculated, with the addition of adequate extras. This calculating system, which in the last 15 years has been generally adopted by the German foundries, is also to serve in future to provide, on the one hand, an adequate profit for the foundries and to counteract such undesirable practices as selling at ridiculous prices below the prime cost and, on the other hand, to render impossible excessive profits on the part of individual undertakings at the expense of the community and thereby to comply with the national-socialistic principle: that the honest labour of every business concern shall be rewarded with a modest profit, but that, above all, regard for the general good should be the primary consideration in all industrial activity.

Charitable Contributions

Contributions to infirmaries and other charitable institutions in the West of Scotland have been made by the employees of various firms, as follow:—

Clyde Crane & Engineering Company, Limited, Mossend, £124; William Denny & Bros., Limited, Engine Department, Dumbarton, £414; Lobnitz & Company, Limited, Renfrew, £95; British National Electrics, Limited, Bellshill, £148; A. F. Craig & Company, Limited, Paisley, £93; Archibald Russell Limited, Polmaise Works, £1,103; Singer Manufacturing Company, Limited, Clydebank, £555 13s. 6d.; Mirrlees Watson Company, Limited, Foundry and Engine Departments, £322; National Steel Foundry, Leven, £88 12s.; A. Balantine & Sons, New Grange Foundry, £66 2s.; The Etna Iron & Steel Company, Limited, Motherwell, £78 10s.; Barr & Stroud, Limited, Glasgow, £140; Albion Motors, Limited, Scotstoun, Glasgow, £600; The North British Locomotive Company, Limited, Glasgow, £784; Bairds & Dalmellington, Limited, Pennyvenie Works, £289 6s.; The Springfield Steel Company, Limited, Glasgow, £65; Dennystown Forge Company, Limited, Dumbarton, £44 5s.; P. & W. Maclellan, Limited, Steel Department, Glasgow, £32 8s.; Shaw, Glasgow, Limited, Maryhill Iron Works, £236 11s. 5d.; Cruickshank & Company, Limited, Denny Iron Works, £133; and James Dougall & Sons, Limited, Bonnybridge, £109; Scotts' Shipbuilding & Engineering Company, Limited, Greenock, £960; J. G. Kincaid & Company, Limited, Greenock, £245; Rankin & Blackmore, Limited, Eagle Foundry, Greenock, £64; Glencairn Metals, Limited, Motherwell, £62; Ramage & Ferguson, Limited, Leith, £35; Lion Foundry Company, Limited, Kirkintilloch, £83; Stewarts and Lloyds, Limited, Coatbridge, etc., £3,762; Blantyre Engineering Company, Limited, Hamilton, £63; Greenock Dockyard Company, Limited, £133.

This Week's News in Brief

Trade Talk

THE ENAMELLING DEPARTMENT of the Grahamston Iron Company held their first annual dance in Mathieson's Rooms, Falkirk, on January 4.

WE ACKNOWLEDGE WITH THANKS the receipt of a refill calendar for 1935 from Messrs. Furmston & Lawlor, Letchworth, to be used in their Magic Ring Calendar.

A COMPANY OF ABOUT 250 spent a most enjoyable evening in the Marlborough House, Glasgow, last week, at the annual dance of the Holm Foundry Society Apprentice Engineers. During the evening the Hon. Kenneth Weir paid a visit.

THE EMPLOYEES OF Messrs. R. B. Tennent, Limited, Whifflet Foundry, with their wives and friends, had a large and happy gathering recently. Mr. James Tennent, managing director, occupied the chair.

THE MOTORSHIP, "Imperial Star," built by Messrs. Harland & Wolff, Limited, at Belfast, for the Blue Star Line, has carried out very successful trials on the Clyde. The vessel has a length of 535½ ft. overall and has a gross tonnage of 10,670.

A START WAS MADE ON January 4 to get the heavy industries of Lanarkshire into operation after the New Year holiday. At all the works the steel furnaces were relighted and rolling operations started on January 7. The holidays this year in most cases were the shortest for a considerable number of years owing to the briskness of trade.

A MEMORABLE EVENT in the history of Messrs. James Dougall & Sons, Limited, firebrick manufacturers, of Bonnybridge, took place on January 4, when the firm entertained 250 employees on the occasion of the completion of fifty years' operations. Mr. E. G. Smith, chairman of the company, presided and several interesting speeches were delivered.

THE GREAT SOUTHERN RAILWAY COMPANY OF IRELAND are spending a sum of £100,000 on the re-equipment of the erecting shop at Inchicore, County Dublin, for expediting the building and repairing of locomotives. It is also proposed to build here another five engines this year, while twelve steel coaches will be built for the new mail train at a cost of approximately £32,000.

AT THE ANNUAL TREAT to the old folk of Newmains and district, on January 5, Mr. W. H. Telfer, managing director of the Coltness Iron Company, Limited, presiding, Mr. J. Hamilton Houldsworth, on behalf of directors, presented to Mr. Thomas Chalmers, who has completed 75 years' service with the firm, a silver salver and a wallet of Treasury notes. Mr. Chalmers started work at the age of 9.

MESSRS. BLYTHSWOOD SHIPBUILDING COMPANY, LIMITED, Scotstoun, Glasgow, have secured an order to build two passenger and cargo vessels for the Furness-Red Cross Line to replace two ships at present operating between Newfoundland and New York. The vessels will each be 320 ft. in length, with 45-ft. beam. The propelling machinery will consist of triple-expansion steam engines supplied with steam from oil-fired boilers.

THE HOLIDAYS AT Messrs. John Brown & Company's Clydebank shipyard have been curtailed this year owing to the necessity of speeding up work on the "Queen Mary" to allow of the fitting-out contractors starting, and also to permit of the completion of the Commonwealth and Dominion refrigerating ship, "Port Wyndham," which has to be delivered to the owners this month. The workers at Messrs. Aitchison Blair & Company, Limited, also were restricted to three days' holiday.

THE ANNUAL DINNER of the Birmingham Branch of the Institute of British Foundrymen, which is to be followed by a dance, will take place on Saturday, January 19, 1935, at the Imperial Hotel, Birmingham, at 6.40 p.m. for 7 o'clock sharp. Ladies are specially invited. Whist is being arranged for those who do not wish to dance. The Council would be pleased for members of other Branches of the Institute to participate. The cost of tickets is 6s. 6d. each, excluding wines, and these are obtainable from the Hon. Secretary, Mr. L. W. Bolton, 21-23, St. Paul's Square, Birmingham, 3.

THE NATIONAL UNION OF FOUNDRY WORKERS has decided to approach the national executives of other unions in the foundry, engineering and allied industries to declare a national policy with regard to overtime. The union executive has received reports from branches and district committees in favour of an embargo on overtime until all unemployed members are absorbed. The executive has circularised other unions with a view to holding a national conference in the hope of receiving national support for the abolition of overtime, consequently reducing unemployment. A circular has also been issued to all the branches asking them to support the executive's request and policy.

A PROVISIONAL AGREEMENT has been reached between the two principal shipbuilding firms in Greenock—Scotts Shipbuilding & Engineering Company, Limited, and the Greenock Dockyard Company, Limited—for an exchange of shipyards. Messrs. Scotts' premises consist of the main shipyard and the Cartsdyke Yard, and sandwiched in between the two is the yard of the Greenock Dockyard Company. Under the new scheme Messrs. Scott will take over the Dockyard premises and the Dockyard will transfer to the Cartsdyke Yard. This will permit of Messrs. Scotts' premises being centralised under one control, instead of being split up as at present, with the result that the organisation will be improved. The advantage to the Dockyard Company will be that they will have greater building facilities and will be able to build ships 20 ft. longer than any ever constructed by them. The Greenock Corporation is keenly interested in the scheme, as the town owns certain ground which comes under the proposed transfer, and in order to facilitate matters, certain concessions have been made.

Contracts Open

Battle, January 19.—Supply and laying 1,000 yds. 4-in. cast-iron water mains, with valves, etc., for the Rural District Council. The Surveyor, The Watch Oak, Battle. (Fee £2 2s., returnable.)

Manchester, January 9.—6,000 yds. of 6-in. and 15,000 yds. of 4-in. socket and spigot water pipes, for the Waterworks Committee. The Chief Engineer, Waterworks Offices, Town Hall, Manchester, 2.

Paignton, January 14.—2,266 yds. of spun-iron water pipes, for the Paignton Urban District Council. The Water Engineer, Palace Avenue, Paignton.

Thrapston, January 18.—500 tons of c.i. pipes, specials, valves, etc., for the Rural District Council. Messrs. Pick, Everard, Keay & Gimson, 6, Millstone Lane, Leicester. (Fee £2 2s., returnable.)

Torquay, February 4.—Iron and steel castings, tools, implements, etc., for the Torquay Corporation. The Borough Engineer.

Company Meeting

Shotts Iron Company, Limited

The annual meeting of the Shotts Iron Company, Limited, was held in Edinburgh. SIR ADAM NIMMO, who presided, submitted the balance-sheet for the year to September 30 last, and this, along with the directors' report, was unanimously approved and adopted. In the course of his speech Sir Adam Nimmo referred to the improvement shown in the accounts over those of the previous year, and expressed confidence that trade, both in coal and pig-iron, had taken a turn for the better.

UNDER THE Additional Import Duties (No. 1) Order, 1935 (S.R. and O. 1935, No. 1), issued by the Treasury on the recommendation of the Import Duties Advisory Committee, Customs duties at the rate of 25 per cent. *ad valorem* will, as from January 9, 1935, be imposed on the following products of vitreous-enamelled or stove-enamelled iron or steel, viz., signs of all kinds, and hearth plates and other plates and sheets (not being hollow-ware) of a description commonly used for domestic purposes. The Committee report that the British manufacturers of these goods have suffered considerably from foreign competition, particularly in regard to enamelled signs and hearth plates where prices have been forced to uneconomic levels. The Treasury Order is published by the Stationery Office, together with the recommendation of the Advisory Committee (Cmd. 4778).

Personal

MR. AND MRS. JAMES NANGLE celebrated their golden wedding on December 31. Mr. Nangle, who is 73 years of age, was for many years employed at Messrs. Colville's Dalzell Steel Works, Motherwell.

MR. JAMES WRIGHT, of Glasgow Road, Clydebank, and his wife attained the fiftieth anniversary of their marriage on January 3. Mr. Wright was the oldest employee of Messrs. John Brown & Company, Limited, engaged on the construction of the "Queen Mary." He is 77 years of age.

MR. AND MRS. SAMUEL GRUBB, Langley Cottage, Muirhead, Chryston, who celebrated their diamond wedding on New Year's Day, have received a telegram of congratulation from the King and Queen. Mr. Grubb was employed with Messrs. Smith & M'Lean, Limited, Gartcosh, for many years.

MR. J. E. HURST, Vice-President of the Institute of British Foundrymen, is to present a Paper before the Graduates' Section of the Institution of Mechanical Engineers on the subject of centrifugally-cast iron, on February 8, at 7 p.m., at the Hall of the Institution, Storeys Gate, London, S.W.1.

HEARTY CONGRATULATIONS from many quarters have been extended to Bailie and Mrs. Alexander McKinnon, of Bainsford, Falkirk, on the fiftieth anniversary of their wedding. Bailie McKinnon is now 70 years of age. A moulder by trade, he served his apprenticeship with Carron Company, and afterwards entered the employment of Abbots Foundry Company, Limited, with whom up to the time of his retirement 14 months ago he had served for over 50 years.

Wills

WILLIAMS, WILLIAM, of Wallasey, foundry owner	£6,238
SIMPSON, FRED, of Davenport (Cheshire), galvaniser, of Messrs. James Simpson & Company, Manchester	£36,148
CRUMP, EDWARD BARNETT, of Coseley, works manager of Cannon Iron Foundries, Limited, Deepfields, Bilston	£2,543
NORTON, D. E., of Hampton Hill, Middlesex, late a director of the Westinghouse Brake & Saxby Signal Company, Limited	£111,367
WEDDELL, JOHN GRAY, of Netherpark, Uddingston, Lanarkshire, director and secretary of Messrs. Hurst, Nelson & Company, Limited, wagon builders, Motherwell, and director of Wagon Repairs, Limited, Birmingham ...	£34,721

Obituary

COLONEL THOMAS WILLIAM ELLIOTT, who carried on business as an iron and iron-ore merchant at Darlington, has died. He was 73 years old.

MR. RONALD FOWLER, chief engineer at the Devonshire Works of the Staveley Coal & Iron Company, Limited, Chesterfield, died recently, after a long illness.

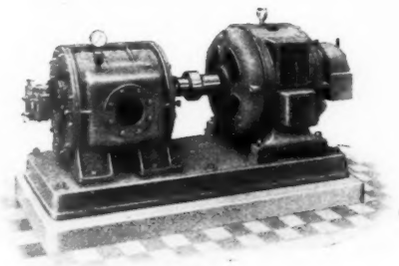
MR. F. KENNERLY PRESTON, of Sheffield, for many years engineer representative of the Mirrlees Watson Company, Limited, Glasgow, and of Messrs. Mirrlees, Bickerton & Day, Limited, Stockport, has died at the age of 63.

MR. HENRY CHARLES SIMPSON, J.P., of Horsehay, Salop, died recently at the age of 83. Apprenticed to the engineering trade in the Manchester district, he was in 1881 appointed manager of an ironworks near Rotherham. In 1884 his appointment by the Coalbrookdale Company, as general manager of their Horsehay works, was the start of a long association with that district. About this time the iron trade became very depressed, and it was decided by the Coalbrookdale Company to close down their Horsehay works, but owing to the enterprise of Mr. H. C. Simpson and his brother, the late Mr. Alfred Simpson, the bridge and structural department was carried on, and as partners these two brothers founded the Horsehay Company, and examples of the bridges and other structures made at Horsehay are to be found all over the world. In 1900 the company was constituted a private limited company. Mr. Simpson took a prominent part in public affairs and was the first chairman of the Dawley Urban Council. He was also a member of the Salop County Council, becoming an alderman before retiring.

XUM

ROTARY COMPRESSORS

ROLLING DRUM TYPE.



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- CUPOLAS
- STEEL CONVERTERS
- MOULDING MACHINES
- CHARGING MACHINES
- SAND MILLS
- LADLES

MODERN FOUNDRY PLANT THAT IS BUILT FOR SERVICE

ALLDAYS & ONIONS LTD
GREAT WESTERN WORKS
SMALL HEATH.
BIRMINGHAM

LONDON OFFICE: 9 VICTORIA STREET·WESTMINSTER·S·W·1

Raw Material Markets

The iron and steel markets have not yet returned to normalcy, and seasonal influences are still lingering, particularly in the North. A certain sluggishness in trade was only to be expected, however, in view of the heavy bookings over the current quarter already accepted by the producers. The feeling is generally optimistic, and satisfaction is expressed at the announcement that the railway companies are contemplating increased expenditure on rolling-stock and track renewals this year.

Sir Andrew Duncan took up his duties as independent chairman of the British Iron and Steel Federation as from the beginning of the year, and it is anticipated that further steps will be taken this year towards the reorganisation of the industry.

Pig-Iron

MIDDLESBROUGH.—The Cleveland ironmasters' reserves of iron have fallen to a comparatively low level and, if the spring demand comes up to expectations, production will have to be increased. It will be remembered that it was at this time last year that an advance was made in prices, but it is not anticipated that a similar step will be taken now, and sellers are prepared to negotiate period contracts on the basis of the existing minimum home prices. These are 67s. 6d. per ton for No. 3 Cleveland G.M.B. pig-iron delivered Middlesbrough, 69s. 6d. delivered North-East Coast, 67s. 3d. delivered Falkirk, and 70s. 3d. delivered Glasgow. The usual 1s. per ton rebate is allowed on the small tonnages of No. 4 foundry and No. 4 forge iron which come on to the market, and No. 1 foundry iron commands 2s. 6d. per ton more than No. 3 in all areas.

There is a strong demand for East Coast hematite. By far the larger proportion of the make for the next two years has already been sold, and the steelmakers are negotiating for further contracts. Home business can only be done at the fixed zone prices, which begin at 69s. per ton for No. 1 East Coast hematite delivered Middlesbrough and rise to 79s. for deliveries in the Birmingham area. Mixed numbers are 6d. per ton below the price of No. 1 quality.

LANCASHIRE.—The demand for pig-iron from this market is gradually resuming its normal volume. A quietly-optimistic view is taken of the prospects for the next six months, although no great change from the conditions existing prior to the stoppage is expected. For delivery to users in the Lancashire price zone, offers of Staffordshire and Derbyshire brands of No. 3 foundry iron are all on the basis of 74s. per ton, with Northants at 72s. 6d., Scottish No. 3 at about 82s. 6d., West Coast hematite at about 78s. 6d., and East Coast at from 75s. to 76s. per ton, according to grade.

MIDLANDS.—Most of the blast furnaces in this area accumulated stocks of iron during December, owing to the slacker demand, but the latter is already picking up considerably and further improvement is looked for. The controlled rates delivered Birmingham and Black Country stations are 67s. 6d. per ton for Northants No. 3 and 71s. per ton for Derbyshire, Lincolnshire and North Staffordshire No. 3, these prices being subject to a small graduated rebate for large consumers. There continues to be a fair call for various types of iron for the general engineering and jobbing foundries. In the aggregate the quantity involved is considerable, the prices varying a great deal. Scottish No. 3 is 85s. 6d. per ton and other low-phosphorus irons are from this figure up to 87s. 6d. per ton. Medium-phosphorus pig is quoted between 72s. 6d. and 80s. per ton. Where refined iron is needed for special work the quotations range from £5 7s. 6d. to £6 10s. per ton delivered.

SCOTLAND.—Some of the works in the Glasgow area resumed work on Monday, but a number are still shut for repairs. All deliveries of pig-iron were suspended last week, and they have not yet been fully resumed. As regards Scottish iron, the official minimum of 70s. f.o.t. furnaces for No. 3 foundry is still in force, 2s. 6d. extra being asked for No. 1. There is no change in the official prices for Cleveland iron, viz., 67s. 3d. f.o.t. Falkirk and 70s. 3d. f.o.t. Glasgow for No. 3 foundry, with No. 4 foundry 1s. less. Other English irons are quoted at 1s. 3d. below these prices.

Coke

Foundry-coke quotations are generally unchanged. Recent new bookings have been of a limited nature, as the larger consumers are already heavily booked over the rest of the winter. In the South Staffordshire district best Durham coke is offered at between 36s. and 40s. per ton, and cheaper grades at 2s. or 3s. less, while Welsh coke varies from 35s. to 45s. per ton delivered South Staffs. A small quantity of Scottish coke comes into the district, and the current rate is from 40s. to 41s. per ton.

Steel

The steel markets have scarcely settled down to normal trading following the usual end-of-the-year interruptions, says the official report of the London Iron and Steel Exchange. In Scotland the works will not fully resume operations until next week. The prospects for the first quarter of the year are regarded as satisfactory. A considerable amount of inquiry is in circulation and deliveries against contracts in hand have been resumed on a heavy scale. In the semi-finished steel branch, business is not expected to recover the activity ruling before the holidays for a time. The makers, however, report that deliveries against contracts in hand are substantial. In most of the finished branches trading is more active than is customary so early in the year. The home market continues to be the mainstay of the industry, and deliveries have been resumed at a satisfactory rate. The volume of inquiry has considerably increased during the past week, and a fair proportion is expected to materialise into new business. The demand from overseas markets remains quiet, but an encouraging business has developed for certain descriptions of steel.

Scrap

The Cleveland iron market has commenced the New Year on a strong note. Machinery metal is very firmly quoted at about 53s. 6d. per ton, with good heavy foundry metal in request at 52s. 6d. In the Midlands, scrap-iron prices remain at the levels which have prevailed for months past, viz., 55s. for heavy machinery metal, 50s. for good heavy pipe and plate, and 47s. 6d. for clean light metal. Activity in the Scottish scrap-iron trade is gradually returning to normal. There have been no drastic changes in prices since the resumption.

Metals

Copper.—Since the opening of the New Year, a distinctly firmer tone has been in evidence in the copper market. There has been a good volume of inquiry from industrial consumers during the past week, and bookings should shortly be made on a heavy scale. Various statements continue to be made about the "world conference of copper producers," scheduled to take place in New York on the 15th inst., but the exact position in this respect is still very obscure.

Daily quotations :—

Cash.—Thursday, £28 8s. 9d. to £28 10s.; Friday, £28 13s. 9d. to £28 15s.; Monday, £28 15s. to £28 16s. 3d.; Tuesday, £28 12s. 6d. to £28 13s. 9d.; Wednesday, £28 8s. 9d. to £28 10s.

Three Months.—Thursday, £28 17s. 6d. to £28 18s. 9d.; Friday, £29 2s. 6d. to £29 3s. 9d.; Monday, £29 3s. 9d. to £29 5s.; Tuesday, £29 1s. 3d. to £29 2s. 6d.; Wednesday, £28 16s. 3d. to £28 17s. 6d.

Tin.—The value of this metal has increased under the firm control exercised by the Buffer Pool Committee.

"The statistics for December were very much as had been anticipated, showing a decrease in the total visible supply of about 1,500 tons; this favourable result failed, however, to make any impression on the market (for some time), as it had been expected and partly owing to the artificial conditions which still govern this metal," report Messrs. Rudolf, Wolff.

Market fluctuations :—

Cash.—Thursday, £228 7s. 6d. to £228 10s.; Friday, £228 12s. 6d. to £228 15s.; Monday, £228 15s. to £229; Tuesday, £230 17s. 6d. to £231; Wednesday, £232 to £232 2s. 6d.

Three Months.—Thursday, £228 5s. to £228 7s. 6d.; Friday, £228 7s. 6d. to £228 10s.; Monday, £228 5s. to £228 10s.; Tuesday, £228 10s. to £228 12s. 6d.; Wednesday, £229 2s. 6d. to £229 5s.

Spelter.—Since the dissolution of the International Zinc Cartel, the spelter market has had quite a strong tone. Future prospects hinge, to a large extent, upon the decision of the Import Duties Advisory Committee with regard to the present 10 per cent. *ad valorem* duty on imports of foreign zinc. If this were removed, it is quite feasible that the Cartel might be resuscitated.

Official quotations :—

Ordinary.—Thursday, £11 18s. 9d.; Friday, £12 1s. 3d.; Monday, £12; Tuesday, £11 17s. 6d.; Wednesday, £11 17s. 6d.

Lead.—"A rather better feeling has arisen, and buyers on 'Change have been more noticeable. The market may also have been rendered optimistic by the announcement that the import duties on lead and spelter are to be reviewed by the Tariff Committee," report Messrs. Henry Gardner & Company.

Day-to-day prices :—

Soft Foreign (Prompt).—Thursday, £10 5s.; Friday, £10 6s. 3d.; Monday, £10 3s. 9d.; Tuesday, £10 3s. 9d.; Wednesday, £10 3s. 9d.

Catalogue Received

Steel Castings. A new catalogue is to be issued by Messrs. F. H. Lloyd & Company, Limited, of James Bridge Steel Works, Wednesbury, Staffs. More or less by accident we received an advance copy and we are perhaps taking some risk in reviewing it. This hazard has been taken because we have not one word of criticism and many of praise. It is dignified, artistic and informative. Restraint is everywhere evident and the management has not, thank goodness, allowed the publicity side to put too much "showmanship" into it. Business men require attraction to the potentialities of a firm by hard, cold facts and not by the exploitation of the latest and often ephemeral arts of modern publicity. As it should, this well-illustrated catalogue radiates confidence in the firm's production.

Institute of British Foundrymen

(*Concluded from page* 40.)

tion, which was to be held coincidently with the Marine and Engineering Exhibition next September.

MR. P. A. RUSSELL, B.Sc., expressed the thanks of the visitors and the hospitality extended to them; he personally had been particularly fortunate in having been the guest of the London Branch on two occasions within the last three weeks, and he was really glad to have the opportunity of expressing publicly the thanks of the East Midlands Branch for the handsome manner in which its members had been entertained on the occasion of their recent visit to London.

He appreciated the references which had been made to his brother, who was President of the Institute a few years ago, and in expressing gratitude for the remarks made concerning himself; he said he was not sure that he was anxious to undertake the onerous duties of the Presidency, as Sir Berkeley Sheffield had suggested, but he hoped that he would be able to serve the Institute as efficiently as his brother had done. He took the opportunity also to pay a tribute to Mr. Delport for his work as Convenor of the Costing Committee of the Institute.

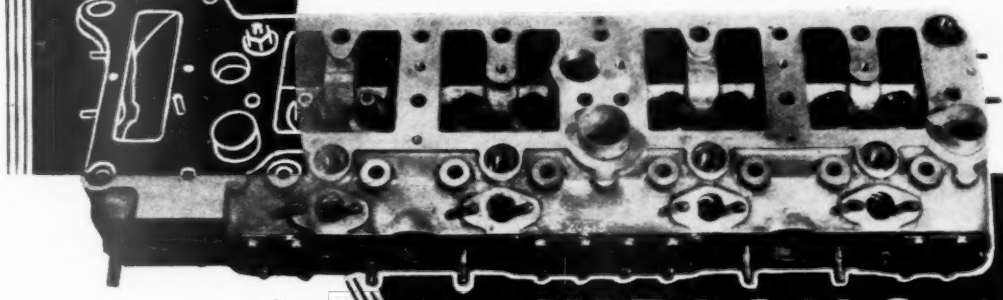
Presentation of Diploma

During the evening MR. ROY STUBBS presented the Institute's Diploma to Dr. A. B. Everest, awarded in respect of a Paper he had presented to the London Branch on "The Potentialities of Cast Iron."

XUM

F.T.J. 10.1.35.

This DIESEL CYLINDER HEAD in ALUMINIUM ALLOY



WEIGHS 60lb.

50% weight reduction has been ensured to this high-speed diesel engine cylinder head by the use of "HIDUMINIUM" R.R.50 aluminium alloy by HIGH DUTY ALLOYS LTD. In addition, it gives:—

(1) Better thermal operating conditions.

(2) No blocking of water passages, because of good corrosion and scale-resisting properties of aluminium alloys.

(3) Comparable costs, because of good machining qualities.

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BARROW IRON

OPEN HEARTH REFINED
REFINED CUPOLA
WEST COAST HÆMATITE

Also SEMI-PHOSPHORIC
for Motor Cylinders, Valve Bodies, Steam and Hydraulic Castings, Etc.

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THE BARROW HÆMATITE STEEL CO., LTD., BARROW-IN-FURNESS. LANCS.

RAW MATERIALS—PRICE LIST

(Wednesday, January 9, 1935)

COPPER

	£	s.	d.
Standard cash	28	8	9
Three months	28	16	3
Electrolytic	31	10	0
Tough	30	10	0
Best selected	31	0	0
Sheets	58	0	0
India	41	0	0
Wire bars	32	0	0
Ingot bars	32	0	0
H.C. wire rods	34	15	0
Off. av. cash, December	27	17	6 5/19
Do., 3 mths., December	28	5	4 1/19
Do., Sttlmnt., December	27	17	10 1/19
Do., Electro, December	31	6	4 1/19
Do., B.S., December	31	0	7½
Do., wire bars, December	31	11	0 12/19
Solid drawn tubes			9½d.
Brazed tubes			9¾d.
Wire			6d.

BRASS

Solid drawn tubes	8¾d.
Brazed tubes	10¼d.
Rods, drawn	8d.
Rods, extd. or rlld.	4¼d.
Sheets to 10 w.g.	7½d.
Wire	7d.
Rolled metal	6¾d.
Yellow metal rods	4¼d.
Do. 4 × 4 Squares	5½d.
Do. 4 × 3 Sheets	5½d.

TIN

	£	s.	d.
Standard cash	232	0	0
Three months	229	2	6
English	232	2	6
Bars	234	2	6
Straits	234	0	0
Australian (nom.)	—		
Eastern	231	15	0
Banca	224	0	0
Off. av. cash, December	228	5	1 1/19
Do., 3 mths., December	228	11	7 14/19
Do., Sttlmt., December	228	5	0

SPELTER

	£	s.	d.
Ordinary	11	17	6
Remelted	13	5	0
Hard	10	15	0
Electro 99.9	14	11	3
English	13	0	0
India	12	5	0
Zinc dust	17	0	0
Zinc ashes	3	0	0
Off. aver., December	11	17	5 3/8
Aver. spot, December	11	14	7 8/19

LEAD

	£	s.	d.
Soft foreign ppt.	10	3	9
Empire (nom.)	11	8	9
English	12	10	0
Off. average, December	10	8	1 17/19
Average spot, December	10	6	3 15/19

ALUMINIUM

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	23	10	0
Do., V.M. ex whse.	22	12	6
Rods	26	10	0

ANTIMONY

	£	s.	d.		£	s.	d.
English	74	0	0	to	75	0	0
Chinese, ex-whse.					67	10	0
Crude					—		

QUICKSILVER

	£	s.	d.		£	s.	d.
Quicksilver	11	2	6	to	11	10	0

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—	
25%	£8 17 6
45/50%	£13 0 0
75%	£18 7 6
Ferro-vanadium—	
35 50	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free	4/6 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£14 10 0
Ferro-tungsten—	
80/85%	3/– lb.
Tungsten metal powder—	
98/99%	3/3 lb.
Ferro-chrome—	
2/4% car.	£29 15 0
4/6% car.	£23 0 0
6/8% car.	£21 12 6
8/10% car.	£21 12 6
Ferro-chrome—	
Max. 2% car.	£34 0 0
Max. 1% car.	£38 15 0
Max. 0.70% car.	£42 0 0
70% carbon-free	10d. lb.
Nickel—99.5/100%	£200 to £205
"F" nickel shot	£184 0 0
Ferro-cobalt, 98/99%	5/3 lb.
Metallic chromium—	
96/98%	2/5 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to £11 5 0
76/80% packed	£11 15 0 to £12 5 0
76/80% export	(nom.) £9 15 0
Metallic manganese—	
94/96% carbon-free	1/2 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to ⅛ in.	1/– lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ¼ in. × ¼ in.	1/– lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

	£	s.	d.		£	s.	d.
South Wales—							
Heavy steel	2	15	0	to	2	16	0
Bundled shrngs.					2	7	6
Mixed iron and steel	2	10	0	to	2	12	6
Heavy cast iron	2	10	0	to	2	12	6
Good machinery					2	15	0
Cleveland—							
Heavy steel					2	11	6
Steel turnings					1	15	0
Cast-iron borings					1	5	0
Heavy cast iron					2	12	6
Heavy machinery					2	13	6
Midlands—							
Light cast-iron scrap					2	7	6
Heavy wrought iron					3	0	0
Steel turnings, f.o.r.					1	14	0
Scotland—							
Heavy steel					2	10	0
Ordinary cast iron					2	11	6
Engineers' turnings					1	19	6
Cast-iron borings					1	17	6
Wrought-iron piling	2	11	3	to	2	12	6
Heavy machinery					2	15	0

London—Merchants' buying prices, delivered yard.

	£	s.	d.
Copper (clean)	24	0	0
Brass	16	0	0
Lead (less usual draft)	9	10	0
Tea lead	6	10	0
Zinc	8	0	0
New aluminium cuttings	66	0	0
Braziery copper	19	0	0
Gunmetal	22	0	0
Hollow pewter	155	0	0
Shaped black pewter	115	0	0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	70/–
Foundry No. 3	67/6
,, at Falkirk	67/3
,, at Glasgow	70/3
Foundry No. 4	66/6
Forge No. 4	66/6
Hematite No. 1	69/–
Hematite M/Nos.	68/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	72/6
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/–
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	67/–
,, No. 3 fdry.	71/–
Northants forge	63/6
,, fdry. No. 3	67/6
,, fdry. No. 1	70/6
Derbyshire forge	67/–
,, fdry. No. 3	71/–
,, fdry. No. 1	74/–
Scotland—	
Foundry No. 1, f.o.t.	72/6
,, No. 3, f.o.t.	70/–
Hem. M/Nos. d d	71/–
Sheffield (d/d district)—	
Derby forge	64/6
,, fdry. No. 3	68/6
Lincs forge	64/6
,, fdry. No. 3	68/6
E.C. hematite	81/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	74/–
Staffs fdry. No. 3	74/–
Northants fdry. No. 3	72/6
Cleveland fdry. No. 3	74/–
Dalzell, No. 3 (special)	102/6 to 105/–
Glengarnock, No. 3	82/6
Clyde, No. 3	82/6
Monkland, No. 3	82/6
Summerlee, No. 3	82/6
Eglinton, No. 3	82/6
Gartsherrie, No. 3	82/6
Shotts, No. 3	82/6

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

	£	s.	d.		£	s.	d.
Iron—							
Bars (cr.)	9	12	6	to	9	15	0
Nut and bolt iron	7	10	0	to	8	0	0
Hoops	£10	10	0	and up.			
Marked bars (Staffs) f.o.t.					12	0	0
Gas strip	10	10	0	and up.			
Bolts and nuts, ¾ in. × 4 in.	14	0	0	and up.			
Steel—							
Plates, ship, etc.	8	15	0	to	8	17	6
Boiler plts.	9	5	0	to	9	7	6
Chequer plts.					10	7	6
Angles					8	7	6
Tees					9	7	6
Joists					8	15	0
Rounds and squares, 3 in. to 5½ in.					9	7	6
Rounds under 3 in. to ⅜ in. (Untested)					8	12	0
Flats—8 in. wide and over					8	12	6
,, under 8 in. and over 5 in.					8	17	6
Rails, heavy	8	5	0	to	8	10	0
Fishplates	12	5	0	to	12	10	0
Hoops (Staffs)					9	7	0
Black sheets, 24g. (4-t. lots)					10	10	0
Galv. cor. shts. (,,)					13	0	0
Galv. flat shts. (,,)					13	10	0
Galv. fencing wire, 8g. plain					14	10	0
Billets, soft	5	10	0	and up.			
Billets, hard	6	17	6	to	7	2	6
Sheet bars	5	0	0	to	5	7	6
Tin bars	5	2	6	to	5	7	6

PHOSPHOR BRONZE

	Per lb. basis.
Strip	9d.
Sheet to 10 w.g.	10d.
Wire	11d.
Rods	10d.
Tubes	13d.
Castings	10½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	20.26
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.50
Basic, Valley	18.00
Bessemer	20.76
Malleable, Valley	18.50
Grey forge, Valley	18.00
Ferro-mang. 80%, seaboard	85.00
O.-h. rails, h'y, at mill	36.37½
Billets	27.00
Sheet bars	28.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.80
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.70
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.60
Plain wire	2.30
Barbed wire, galv.	3.00
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	25/– to 30/–
,, furnace	19/– to 20/–
Durham foundry	20/– to 25/–
,, furnace	17/6
Midlands, foundry	—
,, furnace	—

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box	18/2 to 18/6
,,	28×20 ,,	36/4 to 37/–
,,	20×10 ,,	26/– to 26/3
,,	18¾×14 ,,	18/6 to 18/9
C.W.	20×14 ,,	15/6 to 16/6
,,	28×20 ,,	33/– to 33/6
,,	20×10 ,,	23/– to 24/–
,,	18¾×14 ,,	16/– to 17/–

SWEDISH CHARCOAL IRON & STEEL

	£	s.	d.		£	s.	d.
Pig-iron	£6	0	0	to	£7	0	0
Bars-hammered, basis	£16	0	0	to	£16	10	0
Bars and nail-rods, rolled, basis	£15	15	0	to	£16	0	0
Blooms	£10	0	0	to	£12	0	0
Keg steel	£30	0	0	to	£31	0	0
Faggot steel	£18	0	0	to	£23	0	0
Bars and rods dead soft, st'l	£10	0	0	to	£12	0	0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

		£	s.	d.	
Jan.	3 ..	28	8	9	inc. 2/6
,,	4 ..	28	13	9	,, 5/-
,,	7 ..	28	15	0	,, 1/3
,,	8 ..	28	12	6	dec. 2/6
,,	9 ..	28	8	9	,, 3/9

Electrolytic Copper

		£	s.	d.	
Jan.	3 ..	31	15	0	inc. 5/-
,,	4 ..	32	0	0	,, 5/-
,,	7 ..	32	2	6	,, 2/6
,,	8 ..	31	15	0	dec. 7/6
,,	9 ..	31	10	0	,, 5/-

Standard Tin (cash)

		£	s.	d.	
Jan.	3 ..	228	7	6	No change
,,	4 ..	228	12	6	inc. 5/-
,,	7 ..	228	15	0	,, 2/6
,,	8 ..	230	17	6	,, 42/6
,,	9 ..	232	0	0	,, 22/6

Tin (English ingots)

		£	s.	d.	
Jan.	3 ..	228	12	6	No change
,,	4 ..	228	17	6	inc. 5/-
,,	7 ..	229	2	6	,, 5/-
,,	8 ..	231	2	6	,, 40/-
,,	9 ..	232	2	6	,, 20/-

Spelter (ordinary)

		£	s.	d.	
Jan.	3 ..	11	18	9	dec. 1/3
,,	4 ..	12	1	3	inc. 2/6
,,	7 ..	12	0	0	dec. 1/3
,,	8 ..	11	17	6	,, 2/6
,,	9 ..	11	17	6	No change

Spelter (Electro, 99.9 per cent.)

		£	s.	d.	
Jan.	3 ..	14	12	6	No change
,,	4 ..	14	15	0	inc. 2/6
,,	7 ..	14	13	9	dec. 1/3
,,	8 ..	14	11	3	,, 2/6
,,	9 ..	14	11	3	No change

Zinc Sheets (English)

		£	s.	d.	
Jan.	3 ..	23	10	0	No change
,,	4 ..	23	10	0	,, ,,
,,	7 ..	23	10	0	,, ,,
,,	8 ..	23	10	0	,, ,,
,,	9 ..	23	10	0	,, ,,

Lead (English)

		£	s.	d.	
Jan.	3 ..	12	10	0	No change
,,	4 ..	12	10	0	,, ,,
,,	7 ..	12	10	0	,, ,,
,,	8 ..	12	10	0	,, ,,
,,	9 ..	12	10	0	,, ,,

AVERAGE MONTHLY PRICES OF WEST COAST HEMATITE MIXED NUMBERS DELIVERED SHEFFIELD

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1895	42 8	42 5½	42 6	42 10	43 10	43 7½	44 10	45 11	49 11	48 9	47 7½	47 7½	45 2½
1896	47 0	48 9	48 9	48 2½	47 3	47 3	46 10	46 10	47 2	48 5	50 7	50 6	48 1½
1897	51 2	49 10	48 5	47 4	47 9½	48 6	47 0	47 3	47 3	47 0	48 3½	47 11	48 2
1898	48 9	48 10	49 4	49 8½	50 10	50 3½	51 0	52 5	53 11	55 8	57 3	56 10	52 1½
1899	59 1	59 9	57 7	59 6	64 7	70 10½	76 7½	72 2	74 3	75 0	78 1½	73 3	68 5
1900	75 3½	76 10	79 10	84 6	81 4	79 1½	83 4	81 5	79 11	76 10	77 8½	08 4	78 8
1901	60 2	59 0	57 9½	57 6½	57 8	57 4½	57 8	61 0	60 0½	59 9	58 7½	56 7	58 7½
1902	56 1	57 9½	59 3½	59 9	59 10½	60 0	60 0	60 8½	61 5	61 2	59 3	59 0	59 6
1903	58 5	58 8	61 1	59 5	57 10	57 3	56 7	56 3	55 9	54 8	52 4	52 4	56 8½
1904	52 8½	53 1	53 7	54 0	54 2	53 2½	52 9	52 5	52 2½	52 7	53 1	55 11½	53 5½
1905	57 9½	56 9	58 1	58 2	56 4	55 8	55 5½	56 7	61 0	68 9	69 9	70 11½	60 5½
1906	70 4½	65 2½	63 4½	63 9	64 5	64 6	64 1	66 2½	67 3	69 4½	72 4½	78 8½	67 5
1907	77 9	72 11	71 10	73 9	79 9½	76 9	77 9	78 4	75 11	72 9½	68 6	66 7	74 4
1908	62 7	59 1	61 6½	61 6½	61 4	59 1	57 9½	56 11	60 2	59 2	58 5½	57 7	59 7½
1909	51 4	56 5	55 3	56 1	56 4	57 0	56 8	58 0	61 0	61 1½	60 7½	61 4	58 1½
1910	64 0½	64 3½	66 10½	67 6½	66 2½	65 4	64 4½	65 6½	65 2	64 10½	64 6	65 6	65 4½
1911	66 9	66 1	64 10	63 1	62 1	62 0	61 2	62 2	62 1	61 1	61 10	64 0	63 1
1912	67 0	67 0	67 0	69 3	71 9½	72 11	75 9½	79 1½	82 2½	85 0	85 3½	86 6	75 9½
1913	86 6	86 6	86 3	85 0	83 6½	80 10½	78 1	76 10½	72 6	71 0	68 0	65 3	78 4½
1914	64 6	65 4½	65 6	64 11½	64 2½	64 0	64 0	68 11½	74 6½	71 0	65 4½	69 9½	66 10½
1915	78 9	100 6	103 1	113 6	111 9	114 0	116 3	115 2½	113 8½	121 1½	131 9½	139 6½	113 3
1916	135 0	135 0	133 4	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	129 2½
1917	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6
1918	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6	127 6
1919	127 6	127 6	127 6	127 6	180 6	184 3	195 4½	204 6	204 6	204 6	204 6	204 6	174 7
1920	224 9	235 0	245 0	275 0	290 0	295 0	295 0	295 0	295 0	295 0	295 0	280 0	284 11½
1921	263 4	228 4	180 0	180 0	180 0	160 0	160 0	157 6	142 0	128 6	121 0	115 6	167 9½
1922	125 0	117 6	115 0	115 0	115 0	115 0	113 1½	104 0	105 0	105 0	106 3	110 0	112 1½
1923	109 0½	116 5½	133 11½	138 3½	134 2	125 0	115 7½	111 9	110 0	110 0	113 11	115 0	119 8½
1924	115 0	115 0	114 4½	112 6	112 6	112 6	111 0	110 0	110 0	105 4½	102 6	102 6	110 3½
1925	102 6	102 6	100 0	98 6	97 6	95 1½	92 6	90 6	88 3	87 0	88 1½	88 9½	94 3½
1926	90 1½	90 0	89 8½	89 0	89 0	89 0	90 2½	91 9	94 0	97 2½	*	*	91 0
1927	95 4½	95 6	96 6	95 6	95 3	94 0	92 10½	91 6	90 6	90 6	90 6	89 6	93 1½
1928	85 0	85 3	85 5	85 0	85 3	84 9	84 0	83 9	84 0	84 0	83 1	82 6	84 4
1929	82 10½	83 6	85 0	86 9	87 0	87 3	87 2½	87 6	89 6	89 6	89 6	89 10½	86 11
1930	91 6	91 6	91 6	90 0	89 7½	88 0	87 7½	86 6	86 6	86 6	86 6	86 6	88 6½
1931	86 6	84 6	84 6	84 6	84 6	82 6	82 6	81 6	81 6	83 6	83 6	83 6	83 7
1932	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6
1933	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6
1934	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6	83 6

* No prices available.

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CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.

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(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED

ADVERTISER seeks position as Manager, Assistant Manager or Foundry Foreman; 10 years' experience in similar capacity with well-known South Staffordshire foundry engaged in production of motor cylinders and accessory castings for motor trade.—Box 102, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

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EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of THE FOUNDRY TRADE JOURNAL.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

FOUNDRY Foreman requires position. Excellent experience with high-class work, including repetition work and moulding machines. Metal-mixing. Accustomed to modern foundry plant, estimating and costing. (251)

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WANTED, in small brass foundry, man with £150 capital, half-share; S.E. district.—Write experience, age, etc., "F.," 139, Norwood Road, London, S.E.24.

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FOR Sale, 3-ton Cupola, complete with electric lift, Baker blower, pipes and fittings and staging. Reason for sale, replaced by rotary furnace. Can be inspected on site.—H. W. LINDOP & SONS, Pleck Road, Walsall.

ONE Matthewson's Sand-blast Tumbling Barrel.—Apply, BLACKSTONE & COMPANY, LIMITED, Stamford.

ROTARY FURNACES.

TWO "Selas" Rotary Gas-fired Furnaces suitable for Aluminium or Brass Castings, complete with "Selas" Gas and Air Mixer, completely re-lined with new blocks; capacity approx. 600 lbs. of aluminium each.

One small Brackelsberg type Rotary Furnace, complete with Motor and Rotating Gear; capacity about ½ ton of iron; complete with Motor and Automatic Control Gear.

One Brackelsberg Furnace for 4 tons capacity, complete with Electrically-driven Fans, Tilting Motors, etc., on A.C.

The above in stock and offered cheap to clear.

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NEW Dwarf Cupola, to melt 10 to 15 cwts. per hr. New Worm-geared Ladles, 5 tons, 25 cwts., 15 cwts. and 10 cwts. capacity. Ungeared Ladles, 15 cwts. and 10 cwts. capacity. Improved Cupola Spark Arresters.—T. DAVIES & SON, West Gorton, Manchester.

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Room Plants, sizes 12 ft. x 12 ft., 12 ft. x 9 ft. and 6 ft. x 6 ft., made up in cast-iron sections.

Barrel Plants, 30 in. dia. x 36 in. long and 30 in. dia. x 18 in. long rotary barrels.

Cabinet Plants, in sizes 4 ft. x 4 ft. x 4 ft., 36-in. dia. and 30-in. dia. operators' cabinets.

Most of the above by Tilghman and complete with Air Compressors.

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By Adaptable, Pridmore, Darling & Sellars, etc.; Squeezers by Utard (unused), Samuelson and Britannia, also Farwell Universal Type.

Ladles, Grinding Machines, Exhaust Fans, Blowers, Air Compressors and 500 Electric Motors and Dynamos.

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Vert. Total-encl. Self-lubricated H.S. ENGINES; 8" dia. cyl., 8" str. (Robey).

Shear Blade GRINDER, table 11' 3" with 11' 0" trav.; 9' 0" blades; segment emery wheel.

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30-n.h.p. Semi-Port. LOCO. BOILER, new in 1923, 120 lbs. w.p.

Write for "Albion" Catalogue.

'Grams: "Forward." 'Phone: 23001 (10 lines).

ALBION WORKS, SHEFFIELD.

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Phone: 4044.

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Pattern Maker to Engineering and Motor Trades.

PRIORY STREET, COVENTRY.

MISCELLANEOUS—*Continued*

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STEEL SHOT.—Advertiser, with large connection in foundry and other trades operating shot-blast plants, is in a position to dispose of large quantities of steel shot.—Lowest contract prices should be quoted to Box 998, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

PATTERNS.—Inquiries solicited; quotations by return; shop equipped with modern machinery; quick delivery.—CLEGHORN & COMPANY, Midland Pattern Works, Spring Gardens, Worcester. 'Phone 264.

FLUIDITY TESTS as described in THE FOUNDRY TRADE JOURNAL, February 1, 1934. Patterns of the above in aluminium can be supplied for 35s. per set. Post free. We can also supply Patterns for all branches of the engineering trade, in hard or soft woods. Send us your inquiries.—FURMSTON & LAWLOR, Patternmakers, Letchworth, Herts.

'Phone: 287 SLOUGH

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406 OSBORN jolt rollover.
18"×36" TABOR rollover shockless (portable).
40"×30" TABOR rollover shockless.
TWO BRITANNIA No. 1 jolters.

HAND Machines taken in part payment for above or exchanged.

EXTENDED PAYMENTS ARRANGED.

SANDBLAST PLANTS

12' × 9' Tilghman sandblast room, built of cast iron plates, complete with 400 cu. ft. Tilghman air compressor and all accessories.
T.B. 4 Tilghman sandblast barrel plant, complete. Size of barrel 60" × 40".
T.B. 1 Tilghman sandblast barrel.
Small Tilghman rotary table sandblast.

BUY FROM ME AND SAVE MONEY!

ALEX. HAMMOND, *Foundry Machinery Merchant,*
14, AUSTRALIA ROAD, SLOUGH

PETER—WITH ONE EXCEPTION

With one exception Peter is an ordinary little fellow. Chubby, likeable, just five-and-a-half, full of life and fun and on occasions—be it admitted—of naughtiness.

Just now Peter's rather important, for this is his first term at school, and he's grappling with the intricacies of "A B C" and "Twice-Two": difficult subjects to all men of five-and-a-half, but even more difficult in Peter's case because—bad luck—he's totally blind. That's his One Exception.

Peter learns reading, writing, and 'rithmetic through the medium of "Braille"—dull stuff compared with the coloured picture books of most five-and-a-halfs. However, he's a stout lad is Peter, and he's making great progress.

Would you like to know more about him? How, in spite of his "One Exception," he is being educated and, when older, technically trained and usefully employed.

There is a long waiting list of "Peters" throughout the British Isles, for whom training and accommodation must be provided in the immediate future.

Will you help with a donation or annual subscription? Any sum, large or small, will be gratefully received.

Here's a suggestion. Your eyesight is worth 3d a year to you. Send Peter and his handicapped pals 3d for every year you've had it. Now, please, in case it slips your memory. Good idea?

The Chairman,
SCHOOL FOR THE BLIND
(Founded 1838)
SWISS COTTAGE, LONDON, N.W.3